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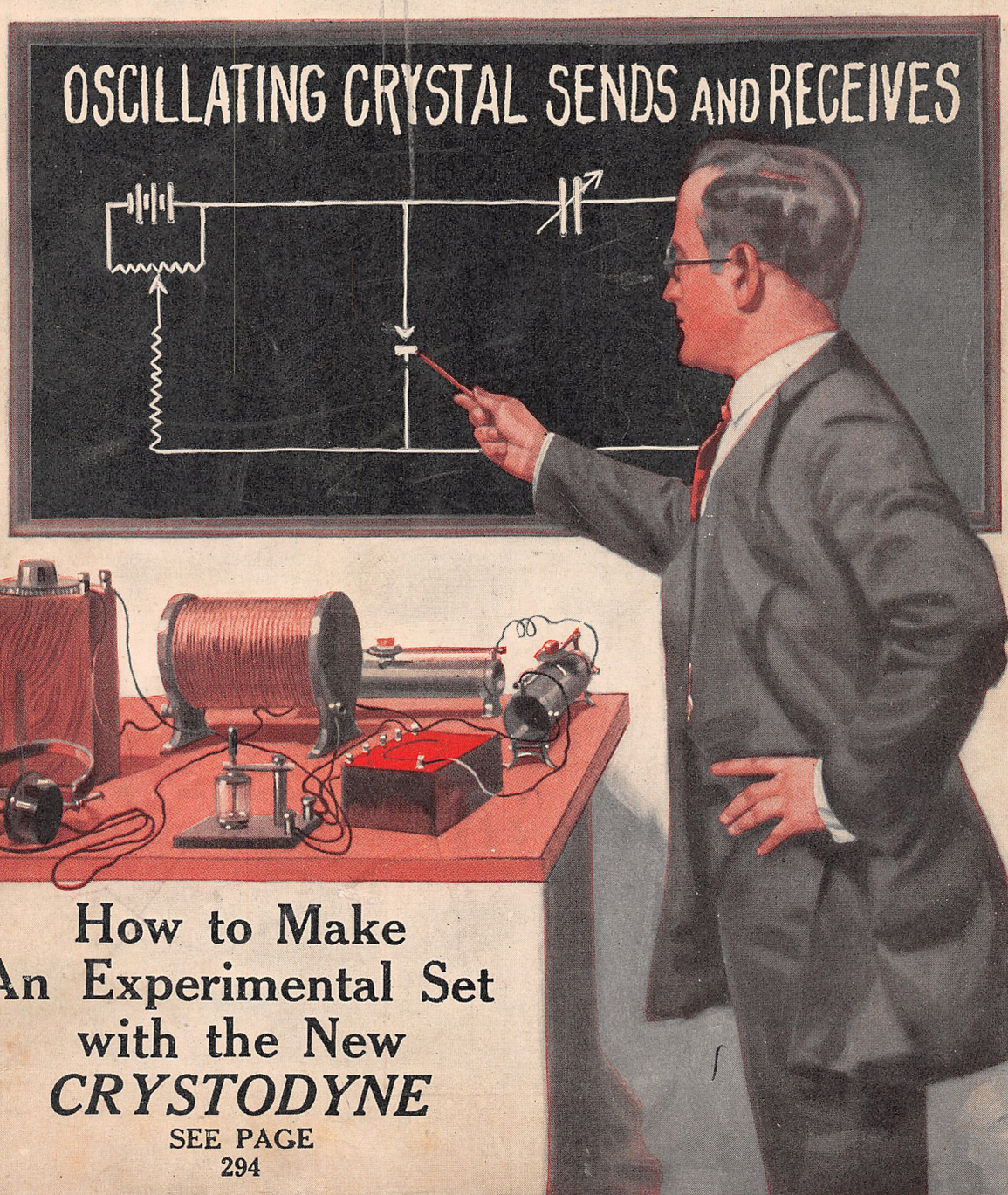

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EXPERIMENTER PUBLISHING COMPANY, NEW YORK, PUBLISHERS OF

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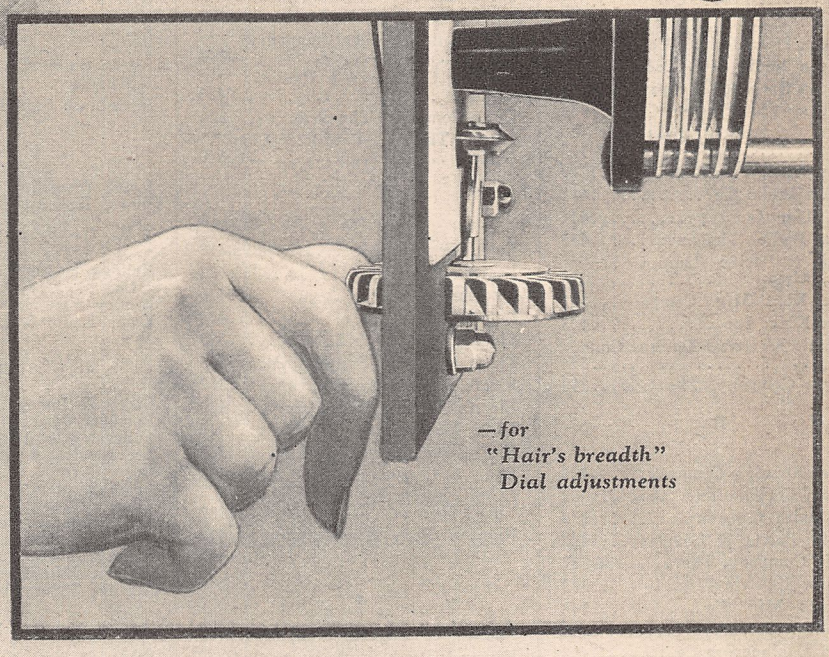

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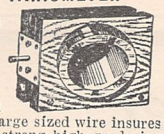

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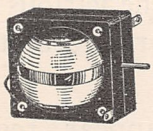

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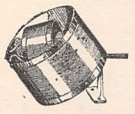

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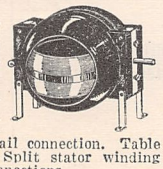

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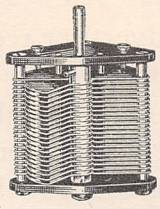
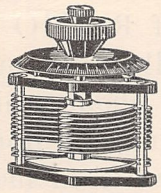




These are especially high grade condensers and we guarantee them to be mechanically and electrically perfect. Fine polished end plates of heavy bakelite. Shafts ¼ inch diameter. Sturdy, heavy aluminum alloy plates perfectly spaced to insure smooth, even, reliable capacity. Our low prices save you money. These condensers are of the very best make and are not to be compared with many inferior, cheap condensers offered. We guarantee them to please you or your money back. The vernier style has one separately controlled plate which permits of the finest tuning. Quality considered, these values are unapproached by others.

REGULAR STYLE

E815— 3 plate 58c
E816— 5 plate 97c
E814—11 plate .00025 mfd. $1.13
E813—21 plate .0005 mfd. 1.27
E812—43 plate .001 mfd. 1.47

VERNIER STYLE
Including Dial and Knobs

E825—14 plate .00025 mfd. $2.45
E824—26 plate .0005 mfd. 2.70
E826—46 plate .001 mfd. 2.95

STANDARD NEUTRODYNE PARTS

E851 Licensed Neutroformer (combined transformer and condenser). Each..$4.78
E852 Licensed Neutrodyne Kit....$14.95
Includes 3 WorkRite Neutroformers, 2 WorkRite Neutrodons, panel layout, paper template and book of instructions.
E853 Licensed Neutrodon. Each.....43c
A very accurate and easily adjusted condenser for neutralizing tube.

SOLID BARE COPPER WIRE

Solid bare copper wire for aerials, leads or wiring instruments.

Solid Bare Copper Wire, size 14.
E240 100 ft. coil..... 48c
E242 500 ft. coil.....$2.25

Solid Bare Copper Wire, Size 12.
E244 100' coil 67c E245 500' coil $3.05

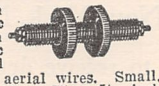
STRANDED ANTENNA WIRE

Cabled of fine copper strands. Very flexible. High tensile strength. Best for aerials.
E248 100' coil 58c E249 500' coil $2.75

ANTENNA INSULATORS

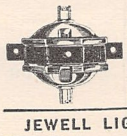
E260 Size 1x3¼. Composition, metal eyelets. Two for 17c
E263 Ribbed Porcelain insulator, 2½ in. long. Ea. 6c
Dozen 55c
E265 Ribbed porcelain insulator — 5 inches long. Each 15c

LEAD-IN INSULATORS



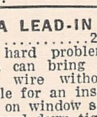
E270 For 4 inch walls or less....42c
E271 For 9 inch walls or less....69c
The only practical lead-in insulator for aerial wires. Small, neat, effective, durable. Fits ⅝ inch hole. Securely locked by two adjustable nuts.

OUTDOOR LIGHTNING ARRESTER



E980 Price.....$1.24
Protect your instruments with this lightning arrester. Weatherproof Bakelite case. Air gap type. Permanent. Durable. Underwriters approved.

JEWELL LIGHTNING ARRESTER



E981 Each.....85c
A dependable protector, always on guard. Small and compact. Weatherproof porcelain case. Easily fastened and connected. Underwriters approved. Lists for $1.10.

ANTENNA LEAD-IN

E259 Each.....25c
Solves a hard problem. With it you can bring in the antenna wire without drilling a hole for an insulator. Place on window sill and window can be closed down tight and locked as before. Takes but a minute to install. Perfectly insulated. Can be bent into any shape. Made of copper strip properly insulated. Neat and durable.

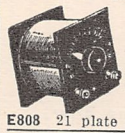
PORCELAIN BASE SWITCHES

Fine white porcelain bases. Copper contacts and blades. Can be used as antenna switches.
E385 Single Pole Single Throw. Ea..20c
E383 Single Pole Double Throw. Ea..32c
E384 Double Pole Double Throw. Ea..50c

LIGHT SOCKET ANTENNA

E251 Each.....97c
Screws into any light socket. Replaces the regular out door antenna. Very satisfactory for nearby stations and under favorable conditions will bring in distant stations. Easy to install. No danger. Gives clear reception with little static interference. Ideal for people in apartment buildings.

ENCLOSED VARIABLE CONDENSERS



One of the best made condensers. Rigid, accurately spaced aluminum plates. Formica ends. Engraved scale. Clear transparent case. Knob and pointer.
E806 43 plate .001 Mfd. $2.80
E808 21 plate .0005 Mfd. 2.45

MIGNON VERNIER VARIABLE CONDENSERS

E827 .0002 M.F. Each.....$2.30
E828 .0005 M.F. Each..... 2.70
E829 .001 M.F. Each..... 2.95
Highest grade instruments. Accurate rating. Extremely low dielectric losses. Independent friction vernier control insures perfect positive adjustment. ¼ inch shaft. No dial included.

TINNED COPPER "BUS BAR" WIRE

Size 14 tinned copper wire. For wiring sets. Best size for neat job and easy soldering.
E957 Round. Ten feet for.....12c
E958 Square. Ten feet for.....14c

SPAGHETTI

For covering connecting wires in sets. For size 12 and 14 wires.
E955 Finest quality braided and saturated with best baked lustrous transparent insulating varnish, 3 feet for.....19c
E956 Best quality braid and covered with black insulating compound. 3 feet for..9c

MAGNET WIRE

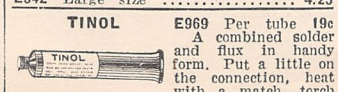
Insulated copper wire. Best quality even drawn wire, one piece to a spool. Prices quoted are for 8 oz. spools unless otherwise stated. Note, our prices are prepaid.

Double Cotton Covered		Enameled Insulation		Single Green Silk-Covered	
Number E990		Number E992		Number E991	
Gauge	Price	Gauge	Price	Gauge	Price
18	39c	20	35c	20	$0.75
20	48c	22	45c	22	.90
22	60c	24	50c	24	1.05
24	65c	26	55c	26	1.15
26	80c	30	60c	30 (4 oz.)	.90
28	95c	32	65c	32 (4 oz.)	1.00
30	$1.15	36	85c	36 (4 oz.)	1.30

RADIO SOLDER SET

E538 Complete ...83c
Handy for soldering radio connections or for general small repair jobs. Consists of soldering copper with handle, sal ammoniac, soldering salts, solder and sand paper.

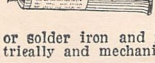
RADIO SOLDERING IRON



E540 $1.35
Soldered connections in radio sets produce better results. This guaranteed iron is exactly right for radio work. A neat solid connection quickly and easily made. Operates on any lighting current 100 to 120 volts. 6 ft. cord with attaching plug. Length 13 inches. Heats quickly, will not overheat.

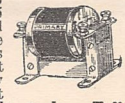
Heavier irons for general repair work. Wonderful values at our prices.
E541 Medium size $3.48
E542 Large size 4.25

TINOL



E969 Per tube 19c
A combined solder and flux in handy form. Put a little on the connection, heat with a match, torch or solder iron and you have a neat electrically and mechanically perfect joint.

OUR SPECIAL AUDIO FREQUENCY AMPLIFYING TRANSFORMERS



E549 3 to 1 ratio..$2.25
E550 5 to 1 ratio.. 2.45
In quality of tone and volume of sound, the things a transformer is built for we guarantee it to equal or surpass any other transformer. Neat in appearance. Carefully made. Fully mounted with plainly marked binding post connections. Wonderful results on one, two or three steps without distortion or howling. A quality item in every respect.

OTHER STANDARD BRANDS AUDIO FREQUENCY TRANSFORMERS

Fresh, Clean Stock in Original Containers

E232 **THORDARSON** Ratio 3½ to 1..$3.30
E233 **THORDARSON** Ratio 6 to 1... 3.70
E553 Acme. Each..... 4.20
E554 Coto. Each..... 4.45
E555 Federal No. 226. Each..... 4.45
E556 Federal No. 65. Each..... 6.35
E712 Radio Corp. Each..... 5.70
E234 All American 10 to 1 Shielded 3.80
E239 All American 5 to 1 Shielded 3.80
E236 All American 3 to 1 Shielded 3.60
E231 All American Push Pull..... 5.10
E557 Erla 3½ to 1..... 4.35
E558 Erla 6 to 1..... 4.35

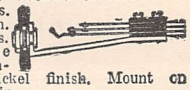
TRICOIL RADIO FREQUENCY AMPLIFLYING TRANSFORMER

E560 For 201A or 301A Tubes $1.58
E561 For 199 or 11 or 12 Tubes 1.58
This transformer will produce wonderful results in any type of regular or reflex radio frequency circuit. Perfect for one, two or three stages. Compact, convenient form, easily mounted. Range 175 to 600 meters.

OTHER STANDARD BRANDS RADIO FREQUENCY TRANSFORMERS

E568 Our special—as good as any of them .....$.48
E562 Dubilier. Each 3.48
E563 Acme. First stage. Each....4.45
E565 Acme. First stage. Each....4.45
E566 Acme. Second stage. Each...4.45
E567 Acme. Third stage. Each...4.45
E714 Radio Corp. Each..... 5.95
E995 All American. Each..... 3.95
E578 Erla. Reflex No. 1. Each...4.35
E579 Erla. Reflex No. 2. Each...4.35

SUPERIOR RADIO JACKS



Finest grade jacks. Improved design. Best materials. Phosphor bronze springs. Silver contact points. Nickel finish. Mount on panels ⅛ to ⅜ in.
E390 Open circuit. Each.....36c
E391 Closed circuit. Each.....45c
E392 Two circuit. Each.....54c
E393 Single circuit filament control..52c
E394 Two circuit filament control....68c

STANDARD JACKS AND PLUG

E387 Open circuit jack. Each.....27c
E388 Two circuit jack. Each.....35c
E396 Plug takes two sets of phones.35c
Well made, durable, smooth working, nickel finished frame. Well insulated.

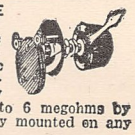
SUPERIOR RADIO PLUGS

E395 With Set screws for fastening cord. Each.....35c
E397 Two-way — takes two pair any style cords. Lists for $1.00. Each..59c
Highest grade plugs. Fit any standard jacks. Polished round barrels.

DUBILIER MICADON TYPE 601

E502 .0001 ...28c
E503 .00025...28c
E504 .0005 ...28c
E505 .001 ...32c
E506 .002 ...32c
E507 .0025...32c
E508 .003 ...40c
E509 .004 ...40c
E510 .005 ...48c
E511 .006 ...60c

SUPERIOR VARIABLE GRID RESISTANCE

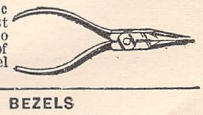


E167 Each.....80c
E168 With .00025 Condenser 98c
Eliminates hissing, clarifies signals. Capacity smoothly varied from 0 to 6 megohms by half turn of knob. Easily mounted on any panel.

GRID LEAKS

E177 Freshman back of panel style...59c
E178 Freshman back of panel style with .00025 Condenser 79c
E171 Freshman base mounting type with .00025 Condenser.79c
E172 Durham Variable Grid Leak with Mounting 89c
E173 C.R.L. Variable Grid Leak...$1.19
E175 C.R.L. Variable Grid Leak with grid condenser $1.48

LONG NOSE PLIERS



E970 Price...95c
The handiest pliers for radio work. Made of fine hardened steel Length, 5 in.

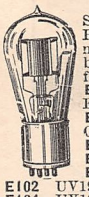
BEZELS

E399 Diameter ¾ inch. Each.....15c
E400 Diameter 1½ inch. Each.....15c
Polished nickel finish. Finest quality. Fit any thickness panel.

THE BARAWIK CO. Chicago's Original Radio Supply House. Beware of Imitators **102 South Canal St., Chicago, Ill.**

WITH BARAWIK STANDARD RADIO GOODS

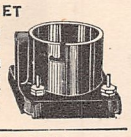
VACUUM TUBES



Standard Brands—Cunningham, Radiotron. Every one guaranteed new and perfect. We will ship brand in stock unless you specify otherwise.

E105 Detector UV200 C300 Each $4.45
E112 Amplifier, UV201A C301A. Each 4.45
E118 5-Watt Transmitter 7.70
E107 WD11 C11. Each.. 4.45
E101 WD12 C12. Each.. 4.45
E102 UV199 C299. Each..... 4.45
E104 UV199 Adapter fits 199 tube to standard socket ..... .43
E108 WD11 Socket. Each..... .30
E109 WD11 Adapter. Each..... .42

BAKELITE TUBE SOCKET



E140 Standard base. 39c
E141 UV199 base.... 39c

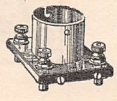
Moulded of genuine red brown bakelite. Binding post connections. For table or panel mounting. Neat and strong.

199 SOCKET

E145 Each 59c

Moulded of high insulating material. Sponge rubber base prevents ringing in tube. Plainly marked binding post connections. Neat and compact.

STANDARD TUBE SOCKET



E150 Each 76c

Bakelite base. Polished nickeled tube. Highest quality socket on the market. Best insulation. Positive contact. Marked terminals. For base or panel mounting.

FILAMENT CONTROL RHEOSTATS

E132 6 ohm. Each.... 38c
E129 20 ohm. Each.... 40c
E131 30 ohm. Each.... 44c
E135 6 ohm. Vernier 95c

Best grade. Will give real service. Durable and lasting. High heat resisting base, diam. 2⅛" in. Tapered polished black knob 1¼" diam.

Potentiometers. Match above rheostats. Same high grade construction.

E151 200 ohm. Each..... 50c
E152 400 ohm. Each..... 55c

OTHER STANDARD BRAND RHEOSTATS and POTENTIOMETERS

E207 Filkostat. Each..... $1.90
E208 Bradleystat. Each..... 1.74
E209 Bradleyometer 200 ohm. Each 1.89
E210 Bradleyometer 400 ohm. Each 2.89
E211 Howard 6 ohm Plain Rheo. Ea. .85
E212 Howard 6 ohm Ver. Rheo. Ea. 1.25
E213 Howard 25 ohm Plain Rheo. Ea. .85
E214 Howard 25 ohm Ver. Rheo. Ea. 1.25
E215 Howard 40 ohm Plain Rheo. Ea. .85
E216 Howard 40 ohm Ver. Rheo. Ea. 1.25
E217 Howard 200 ohm Potentiometer. Each 1.25
E218 Howard 400 ohm Potentiometer. Each 1.69
E219 Klosner 6 ohm Vernier. Each 1.19
E221 Klosner 30 ohm Vernier. Each 1.45
E222 Amperite with mounting..... .95

SUPER-HETERODYNE PARTS

R. F. TRANSFORMER

Specially designed for use in super heterodyne circuit. Very efficient. Completely enclosed in beautiful moulded brown bakelite case, with metal brackets for mounting. 3 required in super heterodyne sets.

E780 Each $5.75

FILTER COIL

Similar in appearance and construction to No. 780 transformer and designed especially for use with it. One required in super heterodyne set.

E781 Each $5.75

OSCILLATOR COIL

Made of genuine moulded brown bakelite throughout. Wound with green silk wire. Designed especially to work with No. 780 transformer and 781 filter coil. One required.

E782 Each $4.35

1 MFD. BY-PASS CONDENSER

Two required in super heterodyne set. May also be used as by-pass condensers in other type sets.

E783 Each 75c

COTO LOW LOSS VERNIER VARIABLE CONDENSERS

We have found this condenser very suitable for use in super heterodyne and other sets requiring a high grade condenser. Plates are of copper silver plated and soldered together and the condenser will not get out of order. Full vernier construction. Vernier is friction drive type and is controlled by separate knob. Condensers are complete with dial and vernier knob. In the circuit shown in our No. 787 blue print two 23-plate condensers are specified.

E784 .00025 mfd. 11 plate..... $3.95
E785 .0005 mfd. 23 plate..... 4.45
E786 .001 mfd. 43 plate..... 5.40

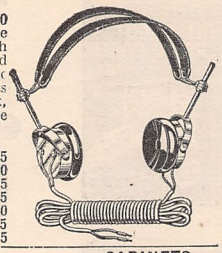
WE PAY TRANSPORTATION CHARGES IN U. S. East of the Rockies

PRESERVE THESE PAGES—ORDER FROM THEM AND SAVE MONEY
FAST SERVICE—TRY US AND BE CONVINCED
THE PRICES QUOTED DELIVER THE GOODS TO YOUR DOOR

OUR GUARANTEE PROTECTS YOU—We handle only the best goods, carefully tested and checked by expert radio engineers. You are assured of getting guaranteed apparatus that will give superior results. And while our goods are best, our prices are lowest. Our goods equal or surpass the claims we make for them. We do not attempt to deceive or mislead. Our reputation for fair dealing is our most valued asset.

HOW TO ORDER—Write your Order plainly, state Article Number, Description and Price of items wanted. Send Postoffice or Express Money Order, Certified Check or Bank Draft for Total of Order. Prompt Shipment is assured when these directions are followed.

BARAWIK QUALITY HEADSETS



E770 Per Set. 2000 ohms $2.60

These headsets have proven on rigid tests to be one of the very best on the market. The tone quality is excellent with an unusual volume. The receiver cases are fine polished finish with polished black ear pieces. Comfortable fabric covered head band. Supplied with 5-foot cord. These sets were designed to sell for much higher prices than we ask, and at our price are a wonderful bargain. We guarantee that you will be pleased with them.

STANDARD BRAND HEADSETS

E754 Baldwin Type C with universal jack plug..... $8.95
E764 Frost, 2000 ohm 3.30
E766 Frost, 3000 ohm 3.95
E751 Murdock 56, 2000 ohm 3.25
E752 Murdock 56, 3000 ohm 3.90
E768 Brandes Superior, 2000 ohm 5.25
E769 Brandes Navy, 3000 ohm 6.95

OUR SPECIAL LOUDSPEAKER

E613 Each..... $7.95

A popular priced loudspeaker selected as our special from a number of different types because of its superior volume and tone quality. Has fibre horn. Heavy base prevents turning over. Height 22 in. Diameter of bell 10 in. 5 foot cord with plug.

STANDARD BRAND LOUD SPEAKERS AND UNITS

E618 Brandes Table Talker..... $9.25
E615 Pathe Loudspeaker 15.95
E616 Atlas Loudspeaker 22.50
E620 Baldwin Loud Speaker..... 22.50
E612 Magnavox R3 Loudspeaker.... 29.50
E614 Magnavox M1 Loudspeaker.... 29.50
E617 Music Master Loudspeaker.... 27.00
E755 Genuine Baldwin type C unit. 5.10
E608 Atlas Unit. Each..... 10.75
E607 Western Electric Unit. Each.. 10.75

UNIVERNIER CONTROL DIAL

E918 For 3/16 inch shaft..... $1.15
E919 For ¼ inch shaft..... 1.15

Replaces ordinary knob or dial. Gives perfect vernier control on condenser, variometer, variocoupler, tickler, etc. Positive easy action. Looks fine. Easily installed. Especially desirable in tuning neutrodyne sets.

COMPOSITION DIALS

E921 Diam. 2 in. for 3-16 in. shaft. Ea. 16c
E922 Diam. 2 in. for ¼ in. shaft. Ea. 16c
E923 Diam. 3 in. for 3-16 in. shaft. Ea. 22c
E924 Diam. 3 in. for ¼ in. shaft. Ea. 22c
E925 Diam. 3⅞ in. for ¼ in. shaft. Ea. 27c

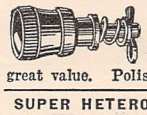
Handsome dials moulded in one piece of polished black composition. 2 inch size has 270° scale marked 0 to 100 finely engraved in contrasting white enamel. 3 and 3⅞ inch size have 180° scale marked 0 to 100.

BAKELITE DIALS

E931—2 in. Diam. for 3-16 in. shaft. Each.. 35c
E932—2 in. Diam. for ¼ in. shaft. Each.... 35c
E933—3 in. Diam. for 3-16 in. shaft. Each.. 39c
E934—3 in. Diam. for ¼ in. shaft. Each.... 39c
E935—4 in. Diam. for ¼ in. shaft. Ea. 48c

Moulded in one piece of genuine bakelite in polished black finish. Finely engraved scale in contrasting white enamel. Sure grip knob that fits the fingers. Higher grade dials for good sets. Match perfectly.

VERNIER DIAL ADJUSTER



E941 Each..... 19c

Easily installed at edge of dial, gives finest vernier adjustment of condenser or inductance. A great value. Polished black knob.

SUPER HETERODYNE BLUE PRINT

Shows circuit diagram, full size panel layout and diagram showing proper location of parts for shortest wiring for 8 tube super heterodyne set. All drilling dimensions given on panel layout are for apparatus listed in this ad.

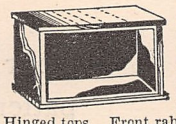
E787 Each 21c

PANELS FOR SUPER HETERODYNE SETS

Genuine black bakelite panels, polished surfaces, smooth edges.

E788 Size 7x36. 3-16 in. thick.. $4.95
E789 Same as 788 drilled as shown on panel layout in No. 787 blue print.. 6.45
E790 Same as 788. Drilled and engraved as shown on panel layout in No. 787 blue print 9.45
E791 Same as 788 but ¼ in. thick 6.90
E792 Same as 789 but ¼ in. thick 8.40
E793 Same as 790 but ¼ in. thick 11.40

CABINETS



Fine looking cabinets solidly built. Elegant hand rubbed dark mahogany finish. You will be proud of your set mounted in one of these cabinets. Hinged tops. Front rabbeted to take panels. Panels not included. Prices are transportation paid. Note that our prices are prepaid.

Panel Size	Inside Dimensions High	Wide	Deep	Art. No.	Price Each
6x 7"	5½"	6½"	7"	E420	$1.95
6x10½"	5½"	10"	7"	E422	2.45
7x10"	6½"	9½"	7"	E421	2.60
7x12"	6½"	11½"	7"	E424	3.05
7x14"	6½"	13½"	7"	E423	3.20
7x18"	6½"	17½"	7"	E426	3.45
7x21"	6½"	20½"	7"	E425	3.85
7x24"	6½"	23½"	7"	E429	4.35
7x26"	6½"	25½"	7"	E431	5.50
9x14"	8½"	13½"	10"	E428	3.55
12x14"	11½"	13½"	10"	E430	4.00
12x21"	11½"	20½"	10"	E432	5.05

RADIO "BAKELITE" PANELS

Notice our very low prices on this fine quality material. Others ask as much for hard rubber panels which are worth much less. We supply genuine Bakelite, Condensite, Celeron or Formica, all of which are materials with practically identical mechanical, chemical and electrical properties. Machines well without chipping. Won't warp. Waterproof. Highest mechanical and dielectric strength. Attractive natural polished black finish which can be sanded and oiled. Note that our prices are prepaid.

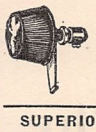
Panel Size Inches	⅛" thick Art. No.	Price	3/16" thick Art. No.	Price	¼" thick Art. No.	Price
6x 7	E450	$.55	E460	$.89	E470	$1.15
6x10½	E451	.86	E461	1.10	E471	1.73
7x14	E458	1.38	E468	1.73	E478	2.76
7x18	E453	1.78	E463	2.27	E473	3.56
7x21	E457	2.05	E467	2.65	E477	5.10
7x24	E459	2.42	E469	2.97		
7x26			E462	3.25		
9x14	E454	1.85	E464	2.35	E474	3.56
12x14	E455	2.42	E465	2.97	E475	4.78
12x21	E456	3.62	E466	4.25	E476	7.13

RUBBER COMPOUND PANELS

Made of a special compound having a rubber base. Equal in appearance and in all essential points to any other class of panels. Fine smooth polished finish. Can be drilled or cut without chipping. Guaranteed not to warp and to be a perfect insulator for radio use. Smooth, clean edges. Thickness 3/16 inch. Size given is in inches.

E481 7x10.. $ .80
E482 7x12.. .90
E483 7x14.. 1.08
E484 7x18.. $1.38
E485 7x21.. 1.65
E486 7x24.. 1.95

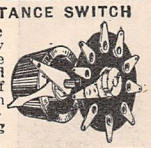
SWITCH LEVERS



Very neat polished black composition knob. Exposed metal parts polished nickel finish. Fitted with panel bushing and two set nuts. A high grade switch.

E381 1¼" Radius. Each 14c

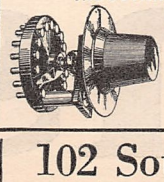
SUPERIOR INDUCTANCE SWITCH



E288 Each 85c

Quickly and securely mounted by drilling one hole. Only knob and pointer show in front of panel. Connections can be soldered before fastening switch, making assembly much easier.

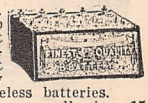
INDUCTANCE SWITCH



E285 Price including knob and dial. $1.18

Mounts switch points and contact lever behind panel. Only one hole needed to mount. 15 switch points, any number of which may be used.

PLATE CIRCUIT "B" BATTERIES



You can make real savings on these batteries. We guarantee them to equal any on the market regardless of price. Extra long life. Don't throw away your money on cheaper inferior useless batteries.

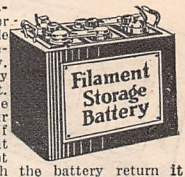
E180 Signal Corps type, small size, 15 cells, 22½ volts. Each..... $1.10
E182 Large size, 5 taps, 16½, 18, 19½, 21 and 22 volts. Each..... $1.45
E184 Variable Large Navy size, 6½x4x3 inches, 5 taps, giving range from 16½ to 22½ volts in 1½ volt steps. Each $1.70
E188 Combination Tapped 45 volts, 30 cell, 13x4x3 battery. Tapped to give 45, 22½, 21, 19½, 18 and 16½ volts. Handles both detector and amplifier tubes. Ea. $3.28

"B" BATTERY METER

E189 Each..... 98c

Reads 0 to 50 volts. Accurately tells you the exact condition of your "B" Battery. Convenient watch size. Polished nickel case with wire lead.

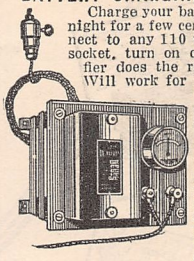
STORAGE "A" BATTERY



A high grade battery. Guaranteed for three years. Made of best new materials. Full capacity. The best battery buy on the market. Try one of these batteries on your set for 10 days. If at the end of that time you are not fully satisfied with the battery return it and we will refund the purchase price.

E194 6 volt, 60 amp. size. Each. $9.90
E196 6 volt, 100 amp. size. Each. 13.25

HOMECHARGER BATTERY CHARGING RECTIFIER



Charge your battery at home over night for a few cents. Simply connect to any 110 volt 60 cycle light socket, turn on current and rectifier does the rest automatically. Will work for years without attention. Simple connections. Give a tapering charge which batteries should have. You can make it pay a profit charging your friends' auto batteries. Long connecting cords with pair of battery clips.

E201 For 6 volt battery..... $12.95
E203 For 12 volt battery..... 12.95

HYDROMETER

E190 Each..... 48c

Accurately tells you the condition of your storage battery. Helps you keep your battery in better condition.

BATTERY CLIPS

E198 Two for 28c

Clip onto storage battery terminals, lead coated. Make positive non-corrosive contact at all times.

WIRE CONNECTING CLIPS

E199 Per dozen 30c

Small connecting clips for quickly fastening leads onto binding posts, etc. Handy and useful. Every radioist should have at least a dozen.

RADIO SWITCH

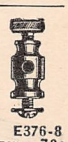
E287 Each 28c

Cuts current on and off instantly by a push or pull. Very neat. Well made. Durable. Saves tubes and batteries.

BINDING POSTS

Brass, polished nickel finish. Washer and 6-32 in. screw extending ⅝ in.

E370 Large size—barrel and knob ¾" long. Dozen 70c



E370-2-4 E372 Smaller size E376-8 barrel and knob 9-16" long. Dozen.. 70c
E374 Large size with composition knob. Dozen 45c
E376 Large size with hole for phone tip or wire. Dozen..... 80c
E378 Small size with hole for phone tip or wire. Dozen..... 35c

SWITCH CONTACT POINTS

Brass polished nickel finish. All have ⅝ in. long size 6-32 screws and two nuts. All prices the same.

Dozen 15c Hundred $1.00

Order by Article Number.

E360 Head. ¼" diam.; ¼" high
E362 Head. 3-16" diam.; ¼" high
E363 Head. 3-16" diam.; 1-16" high

Solder Lugs to Fit Contact Points

Also for connecting wires to binding posts, etc.

E365 **Dozen 8c Hundred 30c**

SWITCH LEVER STOP

Brass polished nickel finish.

E386 **Dozen 18c Hundred $1.05**

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Chicago's Original Radio Supply House. Beware of Imitators.

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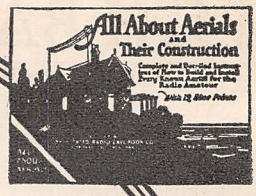
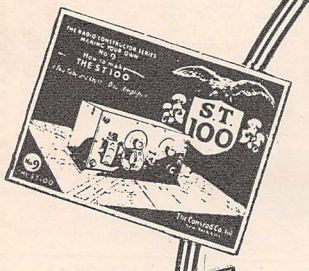
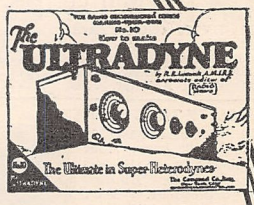
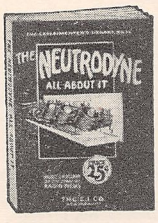


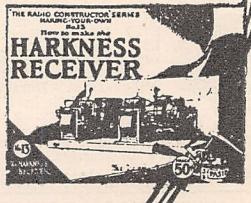


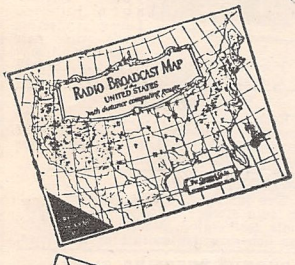


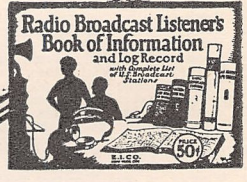
Build Your New Receiver this Month VIA "Consrad"

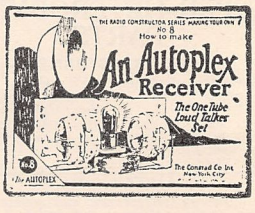
Your pick of Radio books, patterns or diagrams on more than 150 of the Practical Radio Receivers in use today, compiled by the foremost radio authorities in the country and every one authentic, complete and practical—also books and literature on the care and operation of every part of your Radio Set.











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Learn at home in spare time with a few months pleasant study to fill a REAL position in the world's fastest growing industry! Thousands of big pay jobs waiting for trained men on land and sea. Read what one big newspaper says about this crying demand for licensed radio operators.

A Great American Newspaper Says This About Radio Operators:

(This article appeared in the San Francisco Call and Post.)

SHORTAGE OF RADIO MEN THREATENS SHIPPING

By Al. S. Peterson

—o—

A shortage of radio operators threatens the world's shipping.

Unless the American can be lured from the simplicity of the radio telephony and persuaded to learn practical wireless telegraphy, the operator shortage will soon become so serious that it may be impossible to secure enough men to provide radio needs of shipping, according to C. H. Blake, marine manager for the Federal Telegraph Company. He added:

"The situation is not critical at present, but it will be soon. All of the surplus supply of experienced radio operators has been put to work. We just managed to get enough to supply the demand from the cannery fleet and stations this year.

"It will now be necessary for the wireless companies to secure some sort of co-operation from the shipping men and the public if men are to be trained for the work that is demanded by law for certain classes of ships.

"The situation confronting the world's shipping can only be attributed to the lure of the broadcasting. Those vitally interested are arranging to get together for the purpose of planning some method to meet the situation that threatens.

"We believe there should be some feasible method that can be depended upon to attract young men to take up the study of radio telegraphy, which offers an opportunity for travel, health and splendid compensation."

How often you've dreamed of travel—of being able to talk from experience of the gayness of Paris, the splendor of a Mediterranean sunset, the quaintness of a Chilean village, the poverty of Oriental settlements, the antiquity of Egyptian landmarks—these and a thousand other interesting scenes you've read about or seen in movies.

Now you can see the world—not as a hurried tourist who sees little and feels nothing, but with comfort and quietness, and earning splendid money all the while. You can be equally at home on a London tram or in a Venetian gondola; you can be as familiar with the native characteristics of the Chinese coolie as the Spanish peasant; you can in truth be a real citizen of the world, enjoying experiences rarely granted to men.

A Splendid Education The Life of an Officer

You will find that travel affords a splendid education. In your travels about the world you will learn much. You will meet the world's greatest variety of peoples. On board ship you will come into contact with the wealthy traveling public and the prosperous, active business class. In port you will be free to roam around and to explore all the interesting points both in the seaport towns and the surrounding country.

You travel in real style. On board ship you enjoy all the privileges of an officer. Your work is most fascinating. Messages to all corners of the world pass through your fingers. You occupy a position of great responsibility, a position which gives you a fine chance to make valuable connections in case you ever want to give up the sea and settle down and when you do settle down, you settle down with cash in the bank because you can save all your salary.

Radio operators are in big demand on land as well as sea. In case you want to give up the sea, you have a wonderful opportunity of stepping into a splendid land position—operator at a land or broadcasting station or any one of hundreds of the more important big paying positions in radio. The splendid training you receive in qualifying as an operator will bring big money to you no matter where you decide to settle. Our course qualifies for all kinds of radio work.

Send for Radio BOOK

Learn more about this world's fastest growing industry. Send for new illustrated booklet "Rich Rewards in Radio," which describes in detail the glorious opportunities in this field. Radio calls you from land and sea, and offers you more money than you could possibly earn in other fields.

Write now for this interesting booklet which tells you how you can become an operator or qualify for any other of the better positions in radio. It will be sent to you without cost. Mail coupon for it NOW.

National Radio Institute

Dept. 13-JA **Washington, D. C.**

NATIONAL RADIO INSTITUTE
Dept. 13-JA, Washington, D. C.

Please send me your catalog "Rich Rewards in Radio" describing your Home Study Course which will qualify me to become a Licensed Radio Expert and your special short time offer.

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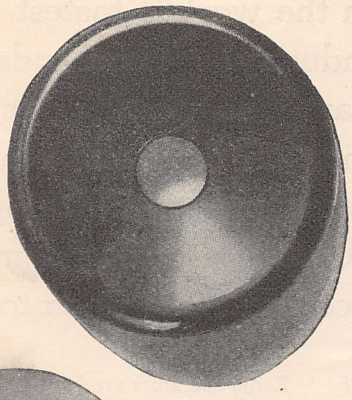
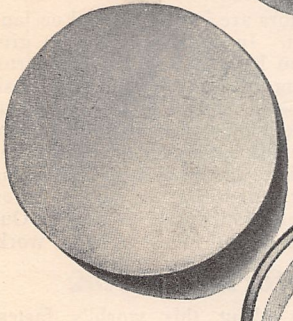
N&K Imported PHONES

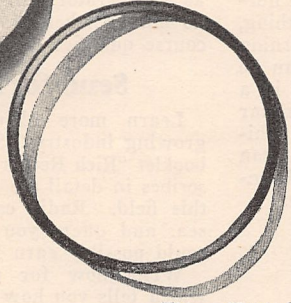
N & K Phones, Model D, 4000 ohms, reproduce more clearly because of their watch-like accuracy of construction, and the increased diaphragm area. The slightly larger ear caps and the sanitary leather covered head bands make them the most comfortable head set. Price $8.50.



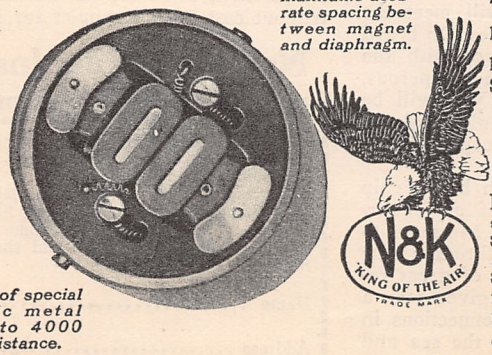
Ear caps accurately machine threaded, to insure proper seating of diaphragm.



Extremely sensitive diaphragm, 2¼ in. diameter.



Thin, calibrated metal washer maintains accurate spacing between magnet and diaphragm.



Magnets of special magnetic metal wound to 4000 ohms resistance.

Built like a watch

THE scientific design and painstaking workmanship of European watches have earned a worldwide reputation. These identical qualities are what have given N & K Phones their remarkable reputation.

As in fine watches, the design is absolutely scientific, the workmanship the highest type of delicate hand-craftsmanship. The magnets are made of a special magnetic metal of a quality that insures uniformity and long life. The ohmage (4000 ohms total D. C. resistance) has been proved by tests to be the most efficient for all general purposes. The diaphragms are peculiarly and unusually sensitive and have a *greater area.* The spacing between the diaphragms and the magnet poles is scientifically correct.

Clear, mellow Tone

The results of this scientific design and painstaking workmanship are evident from the first moment you listen to broadcast music through N & K Phones. The entire reproduction is clearer, mellower, more natural. Every note, highest to lowest, of voice or musical instrument is heard distinctly. Compare them with any other phones you know of and you'll prefer N & K. Sold on a money-back guarantee.

"THE PHONES THE FANS ARE ALL TALKING ABOUT"
is a folder describing N & K Phones in detail. Write for it.

Dealers: N & K Head Sets mean easy sales, excellent profit. Use them to demonstrate your radio sets, especially the small ones. They'll sell the set for you every time. Show your customers the sanitary leather-covered head bands—so easily cleaned. And take advantage of the important fact that there are no come-backs on N & K Head Sets. As an N & K dealer said after handling them for a year: "I have yet to see one pair come back for repairs." We guarantee it fully and carry a complete stock of spare parts. If your jobber is not yet supplied with N & K Head Sets, write us.

TH. GOLDSCHMIDT CORP., Dept. R9 15 William St., NEW YORK

RADIO NEWS
H. GERNSBACK, Editor and Publisher
ROBERT E. LACAULT, Associate Editor
EDITORIAL AND GENERAL OFFICES, 53 PARK PLACE, NEW YORK

Vol. 6 SEPTEMBER, 1924 No. 3

A Sensational Radio Invention

By HUGO GERNSBACK

REAL radio inventions are very scarce these days. As a rule the latest radio sensation proves to be an adaptation of something that existed before, worked into a novel form. When we, therefore, speak of a sensational radio invention we are aware of the fact that we are using a pretty strong term. Nevertheless, we mean just that. We refer this month to the epoch-making invention of Mr. O. V. Lossev of the Government Radio Electrical Laboratory of Russia.

Stated in a few words, the invention encompasses an *oscillating crystal.* A special form of crystal in a special arrangement is now made to oscillate just exactly as does a vacuum tube. It is now not only possible by means of this invention to receive radio impulses, but to generate and transmit radio waves as well, all by means of the little ubiquitous crystal. In other words, THE CRYSTAL NOW ACTUALLY REPLACES THE VACUUM TUBE. That this is a revolutionary radio invention need be emphasized no further.

Dr. Pickard, in this country, we believe, was the first to produce a crystal circuit that actually oscillated. RADIO NEWS in December, 1923, published an account of this exploit. Mr. Pickard, however, was never able, to the best of our knowledge, to obtain worthwhile results from his arrangement. Mr. Lossev, on the other hand, has gone quite deeply into the problem and has solved all the difficulties that lay in his path, in a very brilliant manner.

Two of the greatest German authorities, Count Arco and Dr. Meisner, recently visited Mr. Lossev's laboratory. They not only marveled at Mr. Lossev's invention, which is as novel as it is simple, but they were also greatly astonished at the youth and talent of the inventor.

From what has been said it will be understood now that the oscillating crystal which RADIO NEWS has termed the *Crystodyne Principle* can be used in exactly the same manner as any existing vacuum tube. We can not only detect with the crystal, but we can also amplify with it. We may use any number of them in various circuits in order to bring in great distance or to obtain greater power, the same as we do now with the multiple tube sets. In a short time we may speak of *three or six crystal sets,* the same as we speak now of a three or six tube set.

Just as we can transmit radio impulses by means of continuous waves using the vacuum tube, we can now also transmit with the *Crystodyne,* and, as a matter of fact, a number of students in Russia have actually sent messages with such sets over distances of more than three-quarters of a mile during the past few months.

As a side-light of all this, it should be noted that the Editor has always featured the crystal wherever it was possible. He knew that sooner or later just this thing would come about. His many past editorials on the crystal bear witness to this. The oscillating crystal also explains now how some radio experimenters have been able to obtain such remarkable long distance records with crystal outfits. It would seem that wherever these records were made, the crystal actually oscillated in one way or another without the user being aware of it.

A curious fact about the new *Crystodyne Principle* is that it operates exactly as an arc transmitter. While at present only the crystal *zincite* in connection with a *steel point* gives the real results, there is no question but that other combinations will be found that will work even better. The thousands of friends of the crystal, when they get busy, will in time no doubt, find the correct measures to produce oscillations from other combinations.

That the radio industry is due for an entire revolution through this invention there seems to be no question. But like other revolutionary inventions, the revolution, as a rule, does not come over night. It will take many years for the *Crystodyne Principle* to be adopted in our radio sets. Three to five years may be necessary before that is brought about.

Right here we must sound a note of caution. It must be understood that, for the present, the invention is practically confined to the laboratory and the up-to-date experimenter. *It has not become perfected sufficiently to enter into the commercial stage.* This lies in the future. As wonderful as the invention is, it still has all the troubles and weaknesses of the crystal. There is the usual cat-whisker contact and the usual elusive sensitive spot. Once the contact is adjusted the *Crystodyne* works well, but a knock or jar may put the circuit out of commission.

If you had a Super-Heterodyne using the *Crystodyne Principle* incorporating from six to eight crystals, the job of keeping all of them in operation would be a rather difficult one. Of course, vacuum tubes have not this weakness, although they have others. But for surety of operation the vacuum tube today is supreme. It may take many years for the oscillating crystal to be perfected in such a manner that it will supercede the vacuum tube, but we predict that such a time will come.

Future improvements of the *Crystodyne* will probably be along the following lines: perhaps in some form of a synthetic crystal or perhaps some crystal arrangement in a vacuum that is just as fixed as is the present day vacuum tube. There will then of course be no necessity for cat-whiskers and adjusting means.

The future *Crystodyne* receiving set will therefore be rather small, there being no "A" battery required, all the "B" battery voltage being taken from small flashlight batteries which fit right into the set. Such an outfit would require a good deal less room than the present day outfits.

In the meanwhile, the Seventh Heaven has been opened up to all dyed-in-the-wool radio experimenters. RADIO NEWS hereby makes it its business to bring to its readers, from month to month, all the new developments of the *Crystodyne Principle.*

KDKA's Powerful Short Wave Station

The Station with a Vertical Antenna of Copper Tubing

Very little has been told of the wonderful work that the Westinghouse engineers have accomplished on the short wave transmission. Something of the work they have done manifests itself between the lines of this description.

The new Westinghouse experimental building in which is located KDKA's short wave transmitting station. The unique vertical antenna, consisting of about 50 feet of copper tubing, is seen at the right.

THOROUGHLY aware that short-wave or high frequency wave broadcasting will bring forth the greatest future development in radio broadcasting, the Westinghouse Electric & Manufacturing Co. has completed and has been operating for some time past a new specially designed radio experimental building, erected at a cost of several hundred thousand dollars.

The new building is a one-story concrete and brick structure located on the Greensburg pike, about a mile east of the Westinghouse company's East Pittsburgh works. The site chosen is within a few feet of being the highest spot in Allegheny county, and is one of the level spots available on the hills which dot the locality.

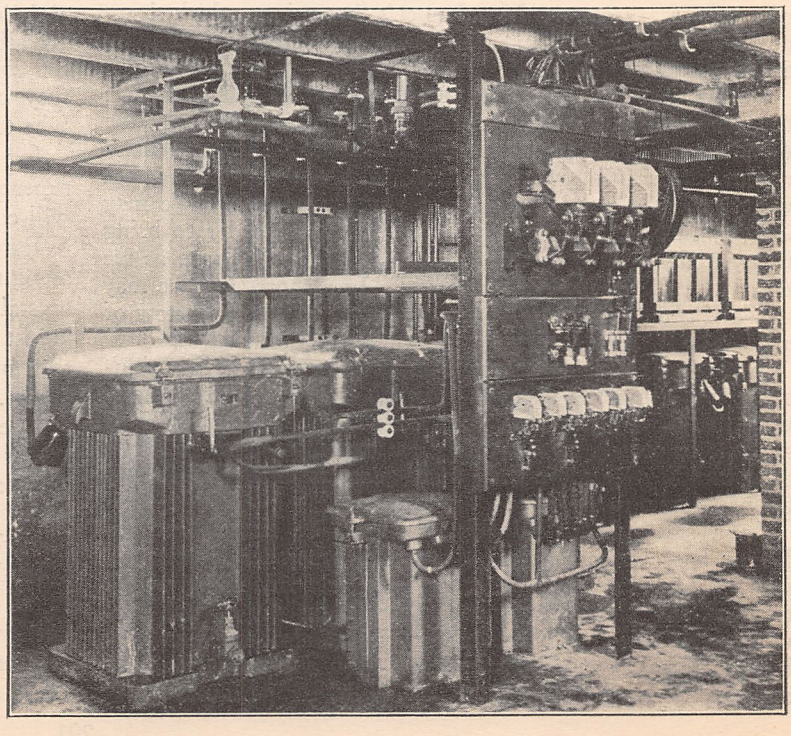
The new site of the short wave station of KDKA is in direct contrast to its former location where, despite some known drawbacks, transmitting with Hastings, Neb., and England was carried on nightly. When first installed, the short wave transmitter was located on the top of a nine-story building directly in the heart of the East Pittsburgh works. Steel buildings known to have a decided absorbing effect on radio waves, completely surrounded the set and, in addition, it was located in a valley with hills on three sides. As a matter of fact, the main transmitter of KDKA is still located in the same place and it is a matter of radio history that all of KDKA's transmitting achievements have been accomplished from this set. However, there is a probability that the 326 meter transmitter will be moved to the very desirable new location.

The new radio experimental building has been so designed that all apparatus contained within it is located symmetrically with respect to all other apparatus.

The basement is divided into several rooms. The main basement chamber contains the high-power transformer plant, motor generator sets, filters, chokes and other apparatus. One of the rooms contains a transformer station of the Duquesne Light Co. The remainder of the basement is occupied by the battery room, furnace room and storage space. Power is brought into the basement through underground ducts from two separate sources, both of which are 4,000 volts, three phase, 60 cycles. This current supply may be stepped up or down as required. The available power supply is in the neighborhood of 250 kilowatts, which can be increased, however, should it be necessary.

With this basement arrangement all bulky apparatus is located out of the transmitting room and is never in sight.

The main apparatus room on the first floor of the building in which are located the oscillator, modulator and rectifier panels

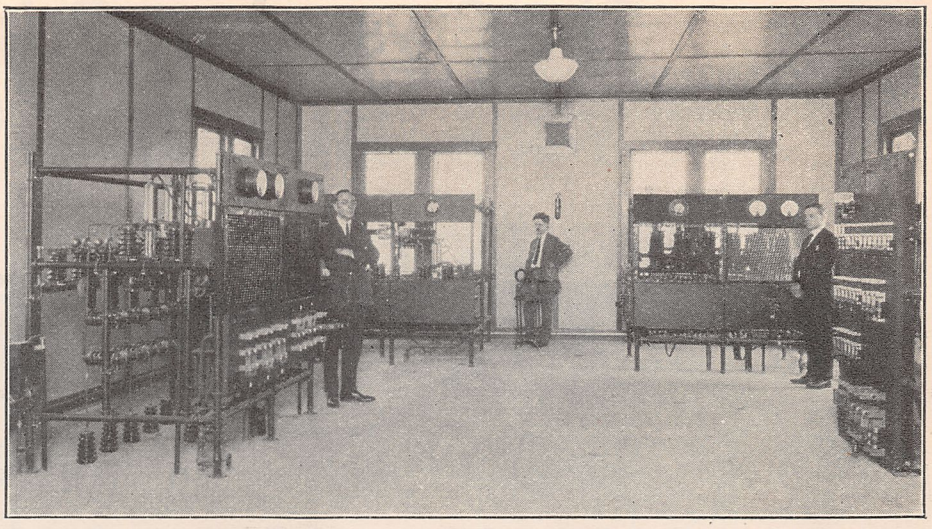


The power room, showing the large transformers and conjunctive apparatus that supply the power to the transmitter. The available power supply is in the vicinity of 250 kilowatts.

is large and spacious and having windows on all four sides is well lighted by day.

The rectifier which furnishes high voltage to the plates of the water cooled tubes is mounted in a specially designed frame so that every part of the apparatus is accessible. Replacement and observations can be conveniently made because every part of the unit is in full view of the observer. The rectifier has a capacity which can be pushed to 150 kilowatts, if it is necessary, and is the result of the several years' experimenting and pioneering of the Westinghouse company in short-wave broadcasting. The rectifier is of the three-phase type, having a tube on each side of the line of six water-cooled rectifier tubes. In front of each tube is a helix of rubber tubing to permit the use of city water to cool the tubes. On the front of the panel is a row of knife switches used to regulate the voltage of the transformers, thus governing the output of the rectifier.

The oscillator panel is of the same general construction as the rectifier panel and makes use of Westinghouse high-power, water-cooled, copper-anode transmitting tubes. They are not ordinarily subjected to maximum capacity, but are usually paralleled. Thus each tube is subjected to about half of its rated capacity and an unusually long life in tubes results. Another reason for paralleling tubes is that operating on the high frequency waves causes unusual stresses and strains to develop, not encountered in the ordinary broadcast wave-lengths and some safety factor is desirable. Immediately behind the tubes is the tuning inductance. In the front of the panel are located the various indicating meters. As in the case of the rectifier, every part of the oscillator panel can be observed and replacements made without difficulty. The modulator panel, using the same general type of tubes, has a switching arrangement whereby the number of tubes used and the amount of power used can be regulated. Indicating meters are mounted on the front of the panel and there is also a modulation meter which shows how strongly the energy generated by the oscillator is being modulated.



KDKA's short wave transmitting apparatus. This room contains the oscillator, modulator and rectifier panels. Note the elaborate insulation to the rear of the panel in the left of the photo.

Adjoining the main room and extending a few feet into it is the control room. The front and extended sides of the room have glass windows so that every part of the apparatus room may be constantly seen by the operator. This room is equipped with amplifying apparatus consisting of two units, one using five-watt tubes, and the other using 50-watt tubes. The start and stop control switches, line terminals, amplifying connections, etc., all are located in this room. Thus the engineer at his desk can control everything in the station. He also can listen in and hear the signals, thus judging them for quality.

Other rooms on the floor include the main office, sleeping room and shop.

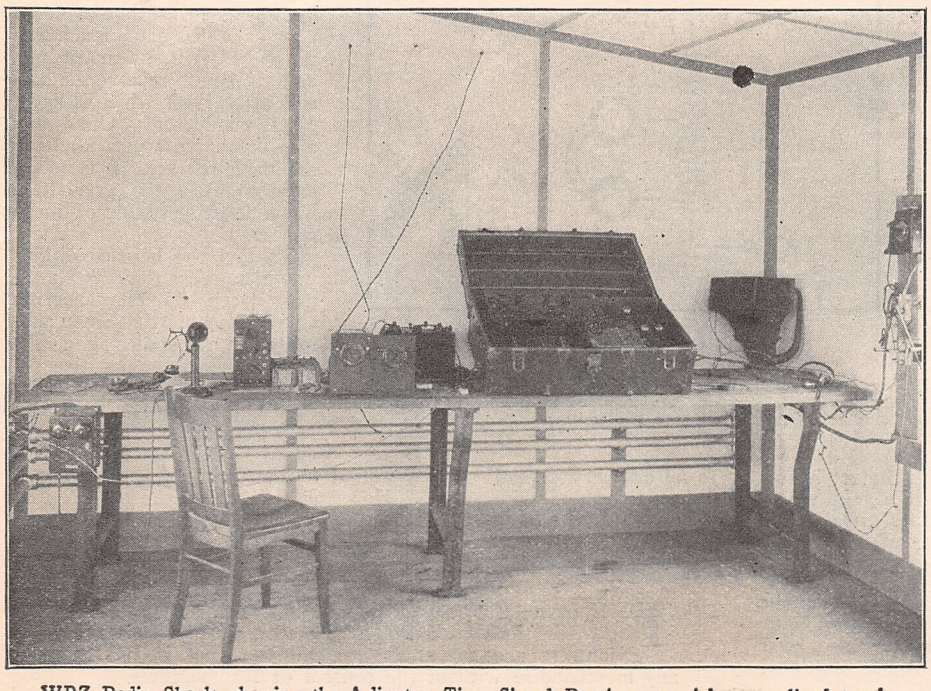
One of the most distinctive marks of the station is the extremely unique short-wave antenna, a special type perfected by Frank Conrad, assistant chief engineer of the Westinghouse company, and the man who made most of the present records possible through short wave development. The antenna is a copper tube erected vertically with respect to the ground and supported from a

(*Continued on page* 422)

The Sensitive Short Wave Receiving Apparatus at WBZ

DAY in and day out, twice daily, Westinghouse station, WBZ, is tuned out at a point "in the same lot," almost directly underneath the antenna towers. This is the stunt which Westinghouse operators perform successfully every day in the week in connection with the relaying of the governmental time signals from the Arlington, Virginia, radio station. WBZ is tuned out by means of a special receiving equipment located in a small radio shack in an out-of-the-way position on the Westinghouse grounds at East Springfield, not more than 1,000 feet from the building on which the antenna towers are built.

The radio shack is an interesting story in itself. It is but a small wooden affair, not more than eight feet high. It is located out on the easterly side of the Westinghouse yard, removed from any of the other buildings. Inside the shack is the special receiving equipment and apparatus used in rebroadcasting the short wave pickups from KDKA at Pittsburgh.



WBZ Radio Shack, showing the Arlington Time Signal Receiver, special copper-lined trunk, wave traps, antenna leads, loud speaker, telephone connections to station and work bench.

The time signals, so important to the farmers, are received from Arlington in this shack and sent to the broadcast station on the roof of the A building 1,000 feet away by means of a lead-covered cable. This operation is performed twice daily, once at 11:55 a. m. and again at 9:55 p. m., Eastern Standard Time.

The special receiving apparatus shows up well in the accompanying photograph. The trunk contains the receiving apparatus, the amplifiers, and all the batteries. Everything in the trunk is shielded so there are no leads outside to pick up the energy from the station. The trunk is copper-lined to shield it from any station interference. It is also grounded to prevent any pickup from the station antenna.

Beside the trunk are to be seen the two wave-traps which tune out WBZ while the Arlington signals are being picked up. The traps are highly efficient, low-loss traps. Two of these must be used because the signal sent out by Westinghouse, WBZ, is so tremendous that one must absorb the loss of the other. All of the equipment in the shack has been so installed that not the slightest interference from the station itself is experienced. If the receiver were not shielded, as described above, it would act as antenna and get a pick-up from the station.

Further assurance against station interference is the reason for placing the shack out in the yard. The antenna for the Arlington receiver is 50 feet long and 20 feet

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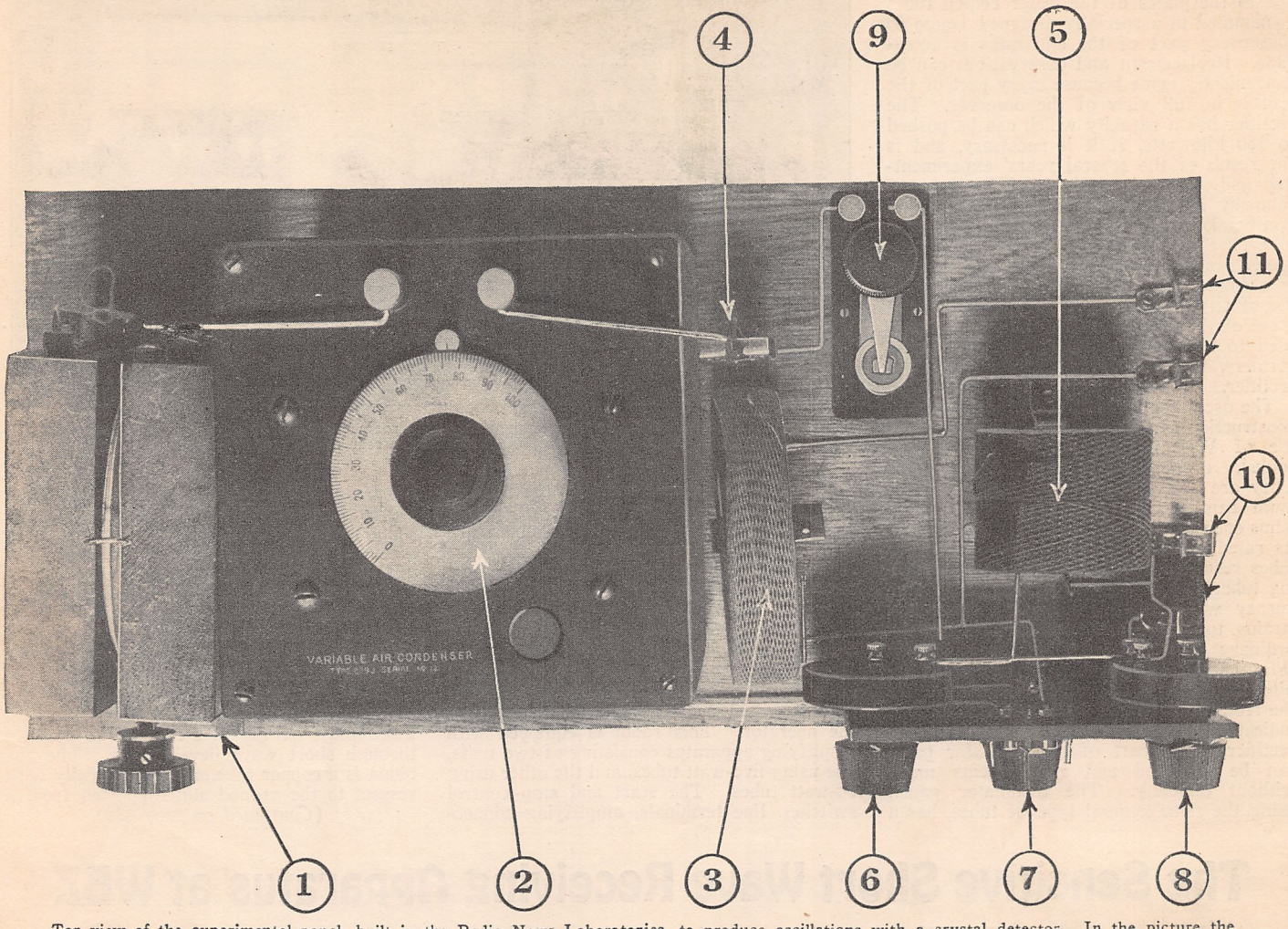
The Crystodyne Principle



Top view of the experimental panel, built in the Radio News Laboratories, to produce oscillations with a crystal detector. In the picture the numbers refer to the following parts: No. 1, variometer; 2, variable condenser; 3, honeycomb coil; 4, .005 mfd. condenser; 5, choke coils; 6, potentiometer; 7, switch; 8, resistance; 9, zincite steel crystal detector; 10, phone clips; 11, battery clips.

SEVERAL experimenters have observed that some contacts, such as crystal and metal or crystal and carbon generally employed as detectors may produce undamped oscillations of any frequency, exactly as the vacuum tube oscillator. The same contact may also be utilized as an amplifier. Oscillating crystals are not new since they were investigated as far back as 1906 by well known engineers, but it was not until lately that a Russian engineer, Mr. O. V. Lossev, succeeded in finding some interesting uses for oscillating crystals. The construction of the apparatus by means of which oscillations may be produced with crystal as a generator seems quite simple and should be of great interest to our readers.

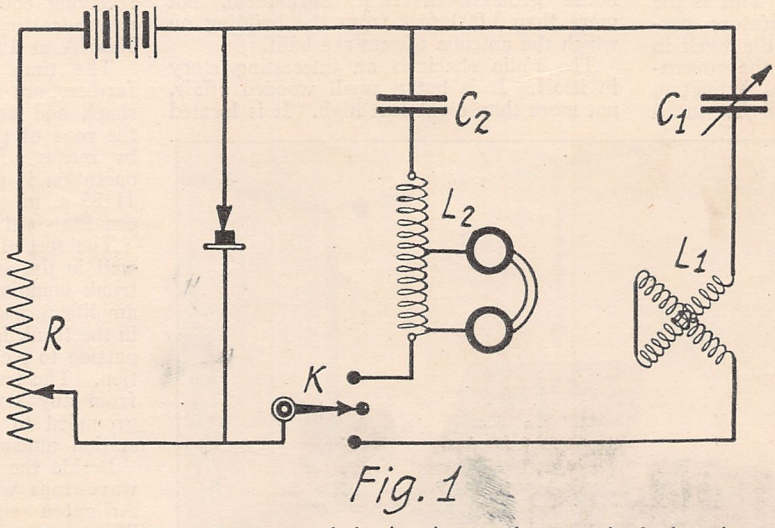


Fig. 1

Diagram of the oscillating crystal circuit. As may be seen, the hook-up is similar to that of an arc transmitter.

Among the numerous contacts studied are pyrite carbon, chalcopyrite-zinc, galena-carbon, or zincite-carbon. The zincite-carbon and zincite-steel contacts seem to be the best producers of strong oscillations. The construction of the contact is similar to an ordinary crystal detector in which a springy piece of wire rests on a crystal. One may use as the cat-whisker, a piece of carbon taken from a broken incandescent lamp, the carbon being a piece of the filament; an ordinary piece of steel wire is also suitable.

The zincite crystals may be selected but it has been proved by experiment that even a poor crystal is made much better if it is fused in an arc, and scraped to remove the outside black layer which is not a good conductor. One may also break the crystal and use the inside surface. It is necessary to fuse the crystal in binoxide or peroxide of manganese.

To find the best conditions in which to use the crystal, one may trace its characteristic curves showing that when submitted to a certain voltage the contact acts as a negative resistance. This negative resistance explains why the crystal may be used to produce oscillations. These curves are generally similar to that of an arc or a dynatron tube. However, it is simpler to try the contact as in an ordinary detector until it functions as an audio frequency oscillator, fur-

THE diagrams, as well as a good deal of the information printed in this article, are published in conjunction with *"Radio Revue"* of Paris. Arrangements have also been made with the inventor, Mr. O. V. Lossev, to furnish additional information on the *Crystodyne* principle.

THE term *"Crystodyne"* has been trade-marked by RADIO NEWS in the United States as well as in Europe. Manufacturers and the trade are cautioned not to use it on any merchandise without the consent of RADIO NEWS.

nishing a musical note which is heard directly in the phones. Once the crystal oscillates at audio frequency, it is easy to replace the audio frequency circuit by one of radio frequency so as to have the contact functioning in the ordinary heterodyne manner.

BATTERY FURNISHES POWER

Fig. 1 shows the connection of a circuit which is made to oscillate by the energy produced from a crystal connected to a battery. The battery may be composed of dry cells such as a "B" battery, provided its inside resistance is not too great. The voltage to apply on the contact is generally between 5 and 30 volts, depending upon the quality of the crystal. In the circuit of Fig. 1, the constants are as follows: R is a rheostat of about 3,000 ohms resistance with variable contact. L2C2 is the audio frequency oscillating circuit while L1C1 is the radio frequency circuit. By means of a switch K, either of these may be connected to the crystal. L2 may be a 1-henry inductance; C2, a 2-mfd. condenser; C1, a .01-mfd. condenser; and L1, a 5-millihenry variable inductance. It is preferable to use phones of about 300 ohms resistance in this circuit. By connecting the circuit L2C2, and by varying the tension of the battery and the value of the resistance R, audio frequency oscillations are produced in the circuit. In order to start the radio frequency oscillations in the circuit L1C1, it is necessary to have an extra switch-point not connected to the circuit between the two extreme ones. It is also necessary to have the high frequency resistance of the circuit L1C1 lower than that of L2C2; it is further necessary that the ratio of the co-efficients of self-inductance in the two circuits be equal to the ratio of their respective capacities. It is possible to keep the proper value of inductance and capacity at all times by using a variometer for the inductance L1, and by mounting on the same shaft the variable condenser C1 so that both are turned at the same time, making the ratio between L1 and C1 about constant for any setting.

With the circuit of Fig. 2, it has been found possible to produce oscillations of very high frequency, the shortest wave-length obtained being 25 meters. The resistance R has a value of 2,300 ohms. The coil L1 is 2¼ inches in diameter and is composed of seven turns of No. 12 copper wire. The variable condenser C1 has a value of .0003 mfd. and L3 and L4 are choke coils used to prevent the high frequency oscillations flowing through the battery circuit. To measure the wave-length, a special wave-meter was used, composed of a coil L2 which is 2¼ inches in diameter and consists of a single turn of No. 12 copper wire shunted by a variable air condenser C2 of .006 mfd. capacity. A galena crystal detector is connected in series with a micro-ammeter, with a scale of zero to 100, allowing the operator to find the resonance point.

However, the production of short wave-lengths even with this arrangement is rather difficult although oscillations of lower frequency may readily

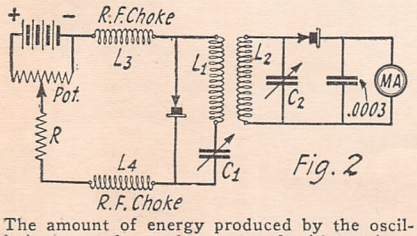
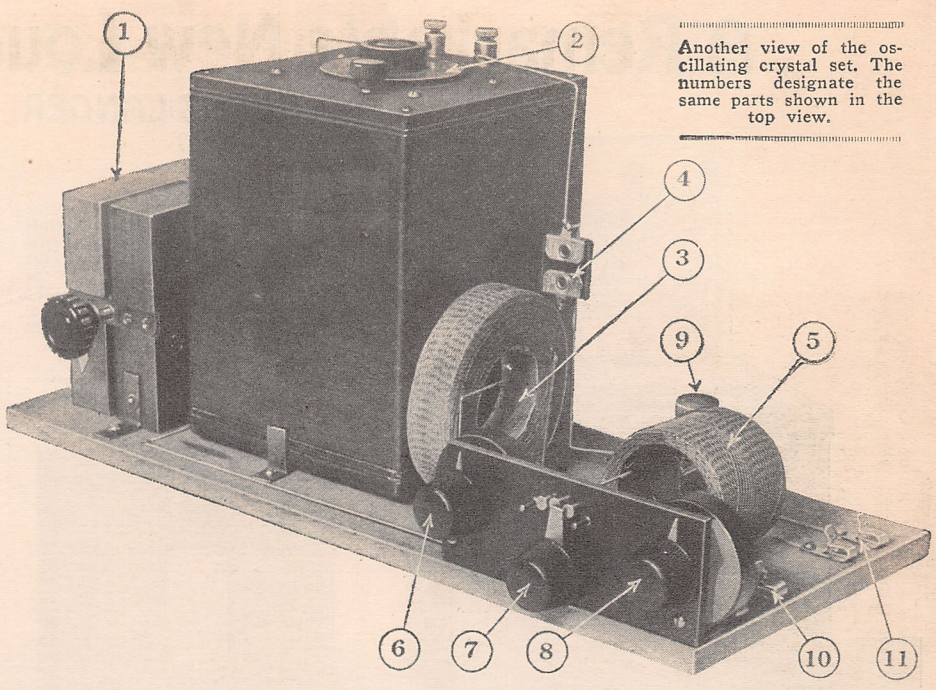


Fig. 2

The amount of energy produced by the oscillating crystal may be measured with a micro-ammeter connected as shown in this diagram.



Another view of the oscillating crystal set. The numbers designate the same parts shown in the top view.

be produced with the same circuit. We shall show in another article how the zincite crystal oscillator may be used for the reception of code signals and radio telephony, and how the same crystal may be utilized as an amplifier and detector.

WE are happy to present to our readers this month an epoch-making radio invention that will be of the very greatest importance within the next few years. The young Russian inventor, Mr. O. V. Lossev has given this invention to the world, he having taken out no patents on it.

It is now possible to do anything and everything with a crystal that can be done with a vacuum tube. The crystal now not only detects but oscillates and can, therefore, be used for amplifying purposes in both radio and audio frequency circuits. It has already been used to *transmit* C.W.

The oscillating crystal opens up an entirely new avenue to the radio experimenter. We will describe from month to month new circuits and new improvements as they are being developed. Our readers are invited to submit their articles on the new Crystodyne principle.

While we do not look forward to having the crystal displace the vacuum tube, nevertheless it will become a very powerful competitor of the tube. We predict great things for the new invention.

—Editor.

GALENA WEAK OSCILLATOR

Some crystals, such as galena, do not produce strong oscillations, although they may sometimes oscillate sufficiently even without any battery in the circuit to produce a beat note when continuous wave signals or a carrier wave are received. This phenomenon, which has been observed several times, explains why some amateurs using only a crystal detector, are sometimes able to receive continuous waves without an outside oscillator. It also explains how it is sometimes possible to pick up very distant broadcast stations on a crystal set installed in such a location that no radiating receivers or re-radiating structures reinforce the signal. Fig. 3 shows a practical circuit for the reception of short wave C.W. signals with an oscillating crystal similar to the one described above. The crystal may be made to oscillate first by the method explained previously; that is, by listening in the phones when it oscillates at audio frequency, then by means of switches the circuit of Fig. 3 may be connected to the crystal. It should be noted that the potentiometer acts as a vernier when adjusted, because the natural period of the crystal depends upon the bend of the negative part of the characteristic curve; that is, the wave-length decreases if the negative resistance increases. For short wave-length, it is recommended to use a fixed condenser of .003 or .004 mfd. across the detector. This arrangement was used by Fuller who connected fixed condensers across his arcs to improve the efficiency and stability of the circuit.

It is possible to obtain regeneration with this system by adjusting the poten-

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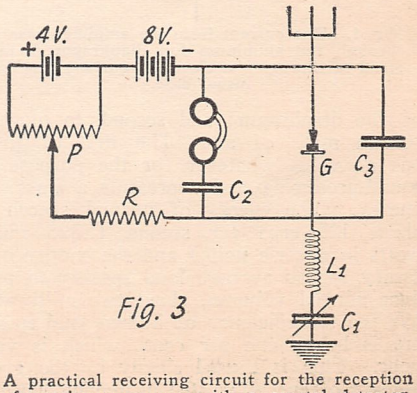
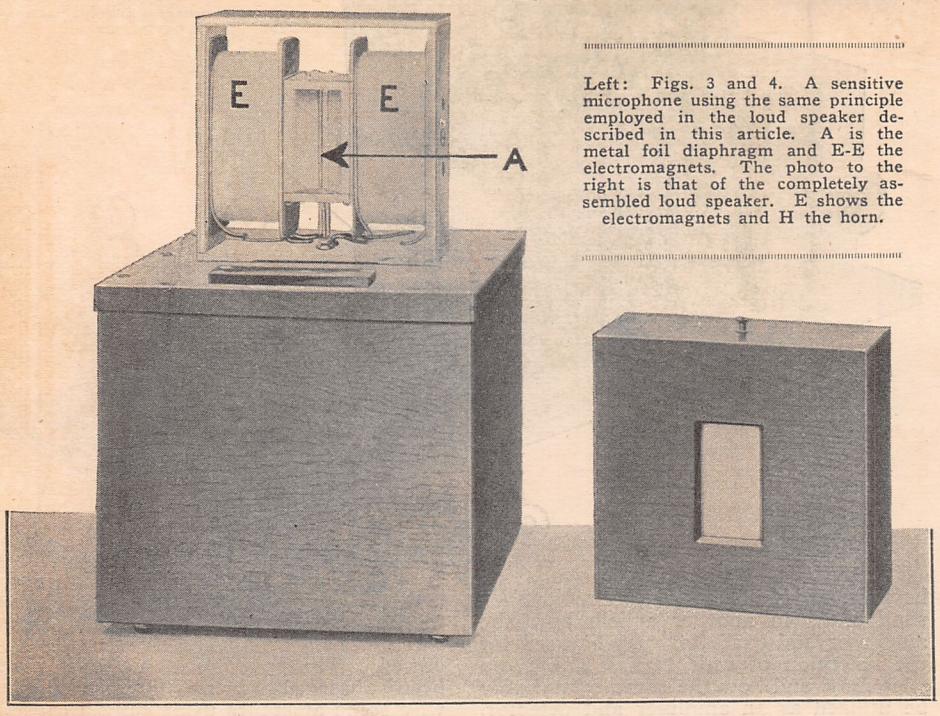


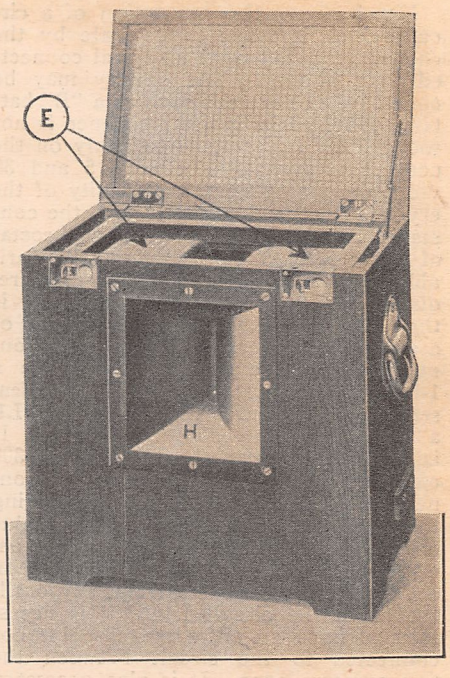
Fig. 3

A practical receiving circuit for the reception of continuous waves with a crystal detector.

A Remarkable New Loud Speaker

By NICHOLAS LANGER





Left: Figs. 3 and 4. A sensitive microphone using the same principle employed in the loud speaker described in this article. A is the metal foil diaphragm and E-E the electromagnets. The photo to the right is that of the completely assembled loud speaker. E shows the electromagnets and H the horn.

DEFICIENCIES of existing loud speakers have been given consideration a great many times. They could be summarized under two principal headings, low efficiency and distortion.

Almost all modern loud speakers produce sounds by means of a diaphragm which in general use can be influenced in a number of different ways, i. e., by a varying magnetic field, by electrostatic attraction of semi-conductors (Johnsen-Rahbeck loud speaker), etc. The electric current flowing into the loud speaker has a two-fold task to perform. First, to overcome the inertia

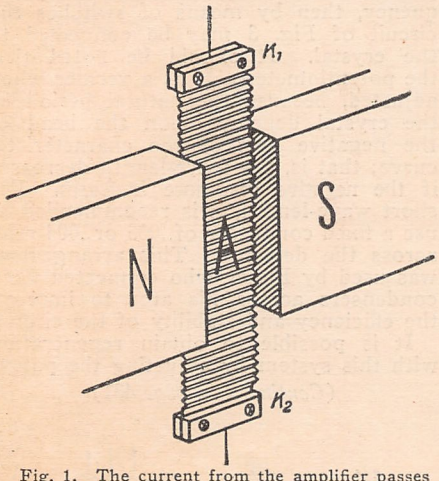


Fig. 1. The current from the amplifier passes through the aluminum foil diaphragm A instead of through the electromagnets, as in the usual case.

of the diaphragm; and second, to move a certain mass of air. The first of these has no value whatever for the purpose of sound-producing and represents a waste of energy. The energy of normal speech is about 125 ergs per second (.0125 milliwatts in electric units) and the energy necessary for an average loud speaker to produce normal volumes, about two milliwatts. We see the efficiency of known loud speakers is below one per cent., which is very poor. This is caused chiefly by the great amount of energy wasted in moving the diaphragm.

Prof. Schottky, inventor of the three-grid (four element) tube, recently conducted a series of interesting experiments in order to find data for the most favorable diaphragm. These experiments and theoretical studies proved that for obtaining maximum efficiency the mass of the diaphragm must not exceed that of the air moved by it. Less mass would be a decided advantage. This condition could be realized only by employing an extremely thin and light metal foil for making the vibrating member. Preferably the foil should be beaten from a metal of smaller specific weight than iron, i. e., aluminum. Aluminum being diamagnetic and, therefore, not attracted by a magnet, it is necessary to reverse the method used today by leading the audio frequency currents through the diaphragm which must be placed in a strong magnetic field.

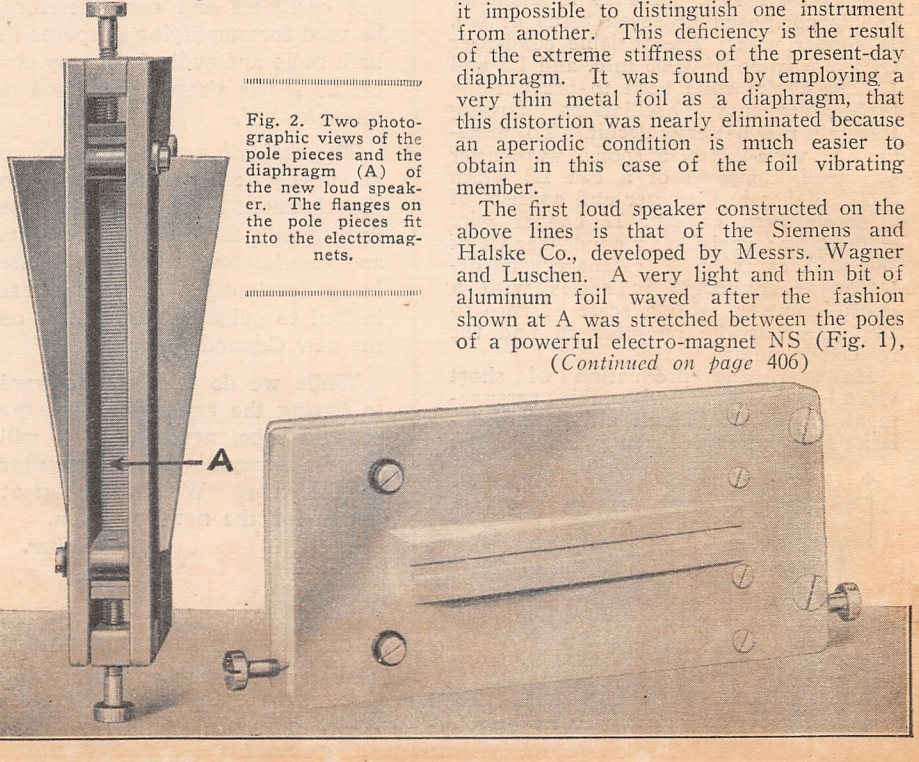


Fig. 2. Two photographic views of the pole pieces and the diaphragm (A) of the new loud speaker. The flanges on the pole pieces fit into the electromagnets.

Distortion of sounds reproduced by a loud speaker has, similarly, its principal source in the diaphragm. It is a well-known fact that diaphragms have a frequency of their own, which means that certain sounds which are near to this resonant frequency or to its harmonics are reproduced too strongly, while others are suppressed entirely or in part. As speech and music are composed of a very wide band of frequencies, and since the natural frequency and harmonics of the diaphragm are numerous, many notes in audible range will be left out.

Also, the timbre of music is determined by overtones which oftentimes have a frequency of upwards of 10,000 oscillations per second. A loud speaker with a conventional diaphragm will drop these vibrations almost entirely with a resulting hollowness in the music which in exaggerated cases will make it impossible to distinguish one instrument from another. This deficiency is the result of the extreme stiffness of the present-day diaphragm. It was found by employing a very thin metal foil as a diaphragm, that this distortion was nearly eliminated because an aperiodic condition is much easier to obtain in this case of the foil vibrating member.

The first loud speaker constructed on the above lines is that of the Siemens and Halske Co., developed by Messrs. Wagner and Luschen. A very light and thin bit of aluminum foil waved after the fashion shown at A was stretched between the poles of a powerful electro-magnet NS (Fig. 1),

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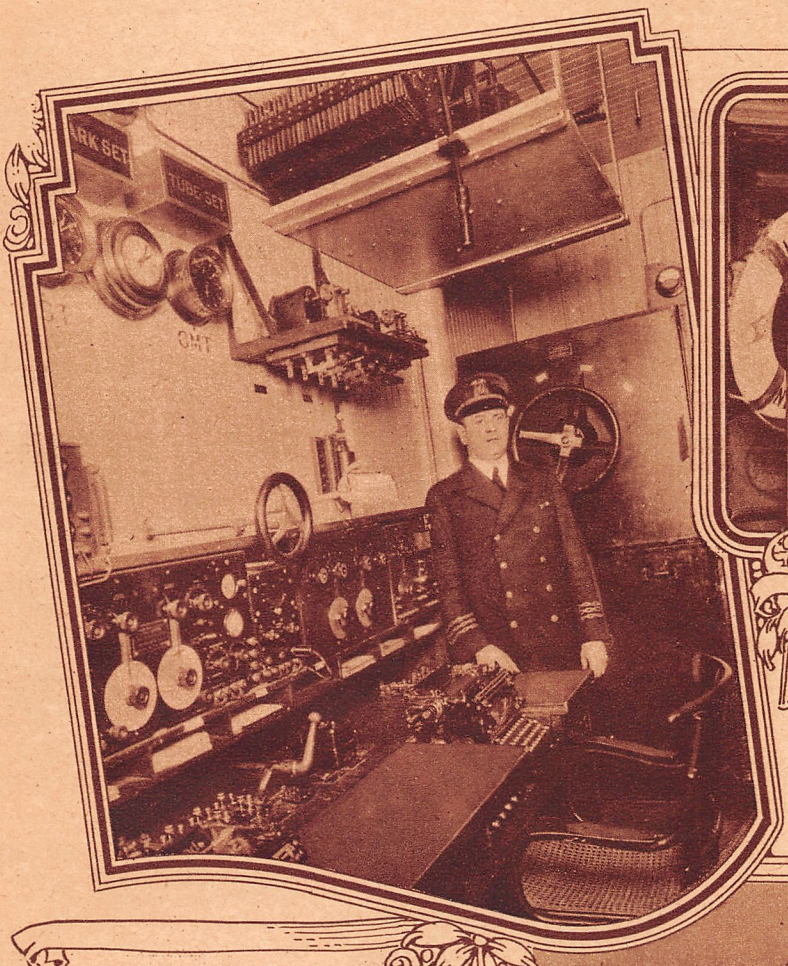
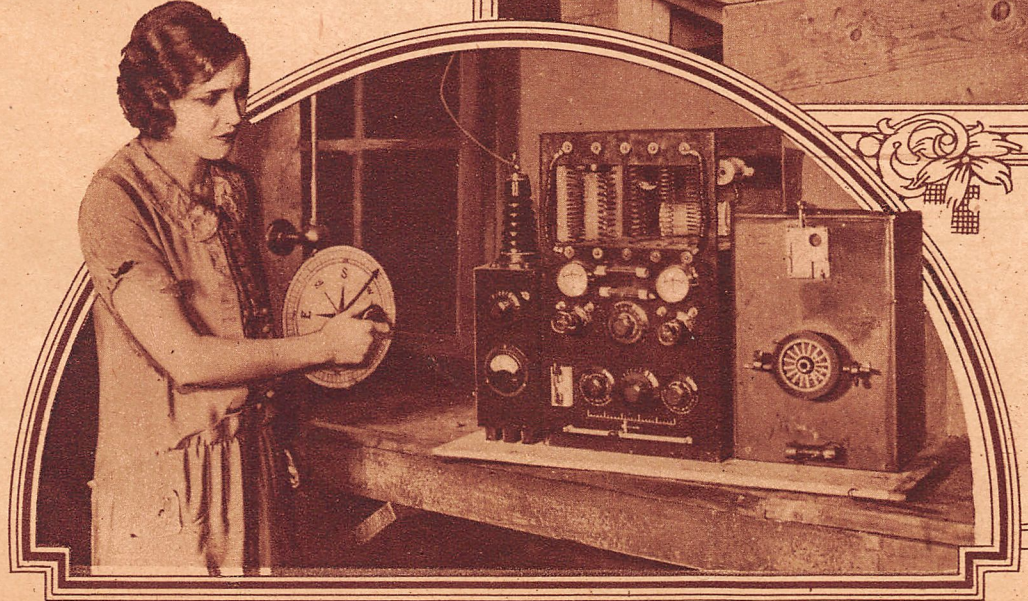
Radio Pictorial

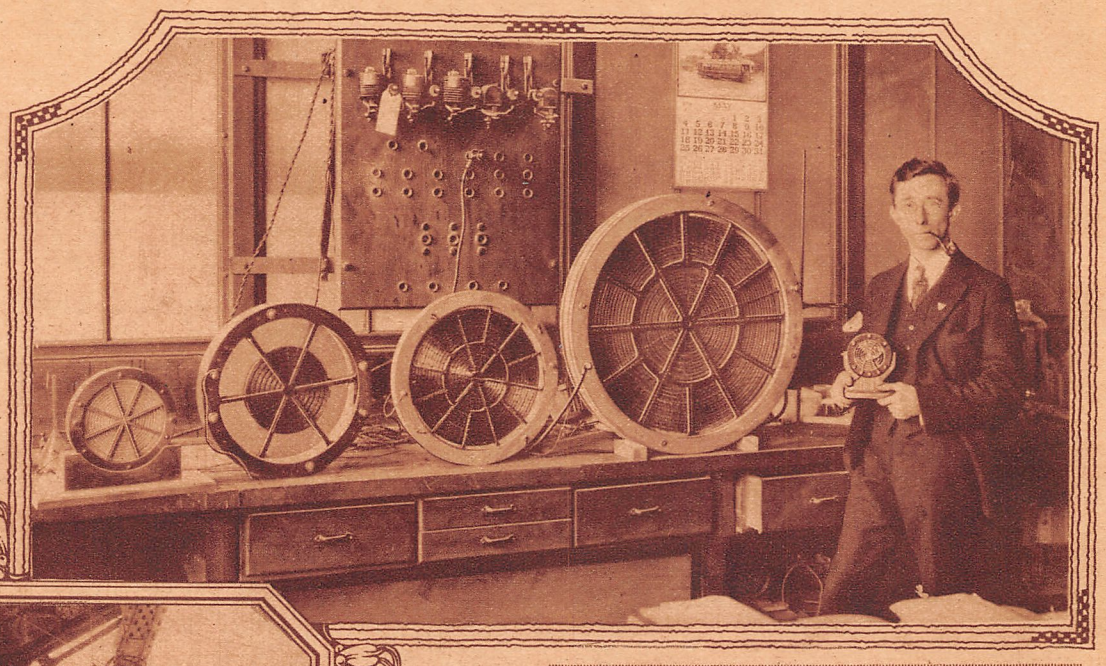


Radio history was made recently when the S.S. Leviathan put out from her New York dock for regular trans-Atlantic voyage and broadcast a dinner being held in her dining salon. Above, several of her guests at the dinner, including Captain Hartly and T. L. Rossbottom, General Manager of the U. S. Lines, are seen speaking before the microphone. At the left is seen the radio operating room of the Giant of the Seas. The voices and music from the dining-room were merely carried over conductors to suitable amplifiers in the radio cabin, where the voice currents were fed into the regular transmitting set. © Kadel & Herbert.

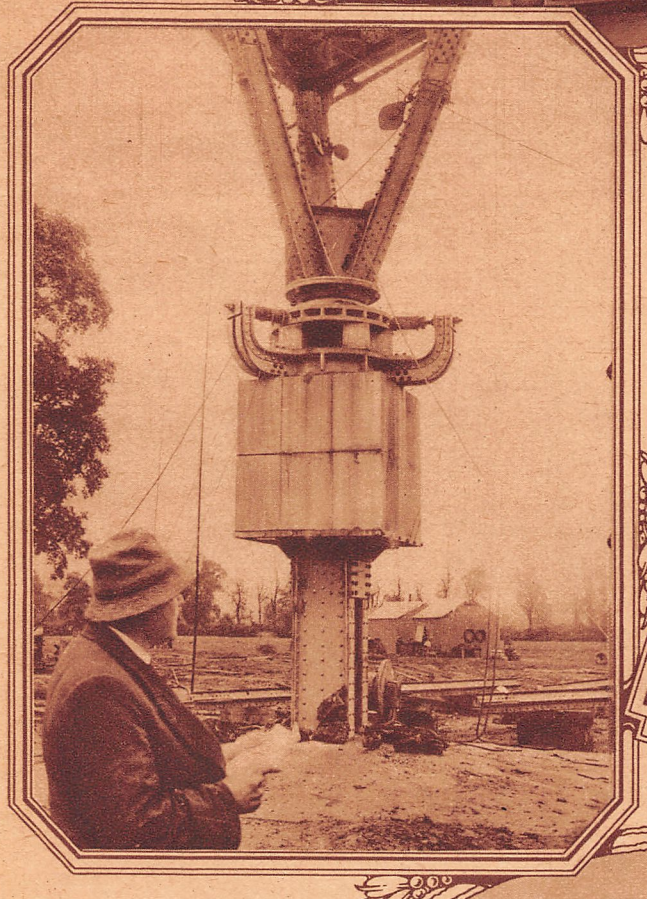
Radio promises to be a force for good citizenship, according to directors of the Knights of Columbus workroom established in one of the most congested districts in New York City. Through the installation of a few simple tools and the provision of a pleasant shop, hundreds of boys—youngsters—who would otherwise be prowling about the streets in a more or less unhealthy atmosphere are given both a valuable knowledge and pleasurable pastime. Instructor Robert S. Cousins is shown standing with a group of the boys. Aside from teaching them the necessary handicraft of building radio sets, he explains the underlying principles so that they understand the operation of their sets. © Foto Topics, Inc.



Nary an invention but has its movie play. Comes now the Famous Players together with one Agnes Ayres with a marvelous new picture in which there are all sorts of heavy scientific gestures, huge coils, a lot of radio dials, and a couple of cast-off ammeters, all of which, shaken well and poured out with the proper musical accompaniment, make one Hot Dawg thriller! See photo left for winsome young lady and Fearful Death Ray Machine. © K. & H.

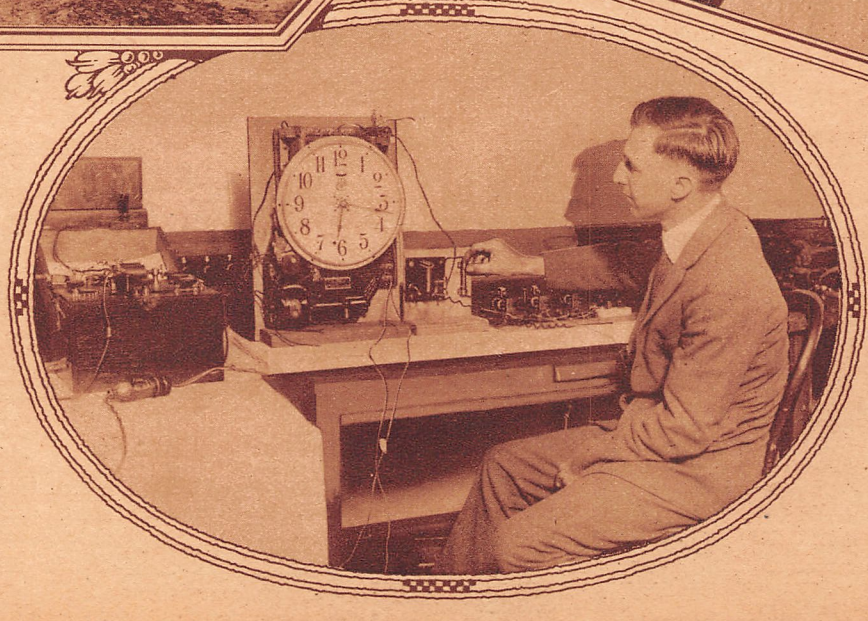


Right: The engineering staff of the General Electric Company has developed this new type of loud speaker which is destined to replace all former types in cases where great volume is requisite. A number of different sizes are shown, but in basic principle they are all the same. The loud speaker consists principally of two large helical coils of wire between which is placed an aluminum diaphragm of like size. This diaphragm is actuated by the strong current passing through the coils. It is an application of magnetic induction. It is said that perfect reproduction is secured.



Above: The largest wireless masts in the world are being erected at Rugby, England; they will support the huge aerial of a high powered radio telephone station to enable the linking, by voice, of London and New York. Each mast weighs 140 tons and is 820 feet high. Elevators will run up the centers to allow working men to make repairs above at any time. Sixteen are to be erected. The photo shows the great insulating block and pivot at the base of one of the masts. © International Newsreel.

Below: The new Hunts Point Hospital has taken the initiative of bringing forth the benefit of radio to the sick within its care, and after considerable experiment, the installation of radio has been made a permanent feature. The radio station is located in a separate room on the roof, and cables lead from there to every ward and bed in the hospital. Patients plug ear phones into the wall sockets when they want to listen in to concerts. © Kadel & Herbert.

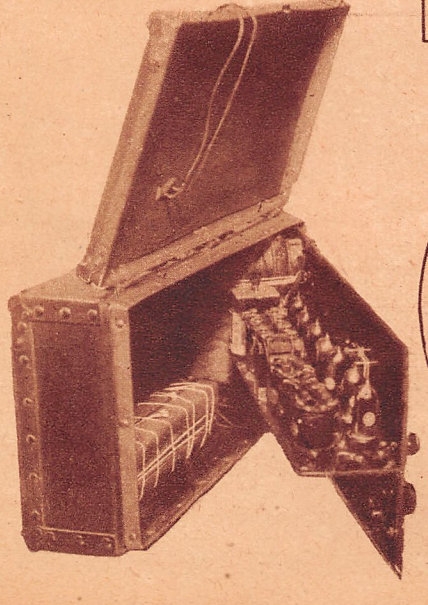


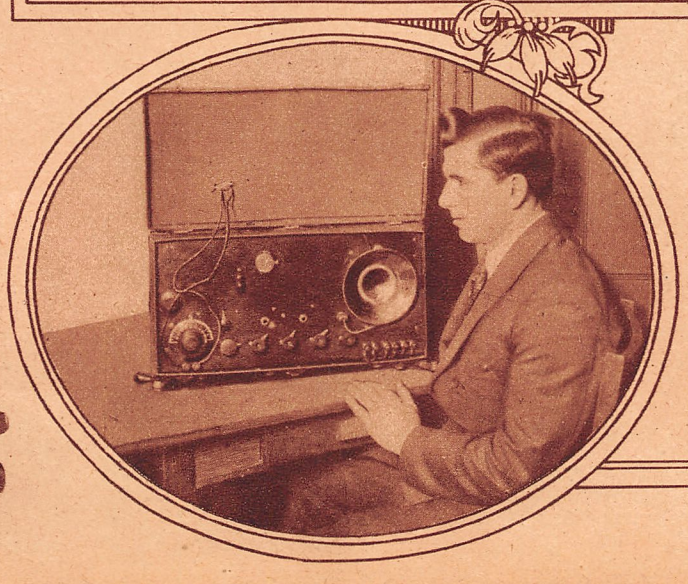
Left: This apparatus is used to set hands of a clock by a radio relay, worked in conjunction with a series of retardation relays, so that dots sent during the radio time transmission do not operate the clock setting mechanism, but the dash at 12 (noon) or 10 P. M. will perform the operation. The adaption of the clock to radio control was done by F. W. Dunmore, physicist of the U. S. Bureau of Standards, Washington, D. C., who devised the retardation relays. © P & A Photos.

Right: Station 2CMG is one of the best known among the New York Hams, probably because it handles a great deal of business. Owned and operated by the Hudson River Yacht Club, it keeps in constant touch with the craft belonging to members of the institution. The photo at the right, which gives a complete view of the very adequate transmitting and receiving apparatus, shows several members of the club listening to preliminary reports of speed tests while preparing plans for the summer's regatta. © Foto Topics, Inc.

If you have the instincts of the "Compleat Angler" and at the same time are burdened with a Cromwellian conscience, which makes it practically impossible for you to practice your favorite sport on the holy day of rest, why not take the diplomat's course and effect a compromise? All of which is to say, if you want to go fishing and are afraid of being caught red-handed by your beloved minister, take along a portable radio set and tune in a good, healthful soul-stirring sermon while watching the float on your line. Thiswise the girl, at the left, solves her problem. © Foto Topics, Inc.

Right: One of radio's bug-bears is loud speaker reproduction. It seems almost impossible, at times, to make a piano sound like a piano if any great volume is desired. However, Paul De Kilduchevsky, a New York inventor, seems to have at least made an approach to the solution of the problem. Judging by the crowds that gathered beneath the office building atop which he placed his new loud speaker attached to a receiving set, he gained a fair amount of successful natural reproduction. There were no details regarding the invention given out. © Kadel & Herbert.

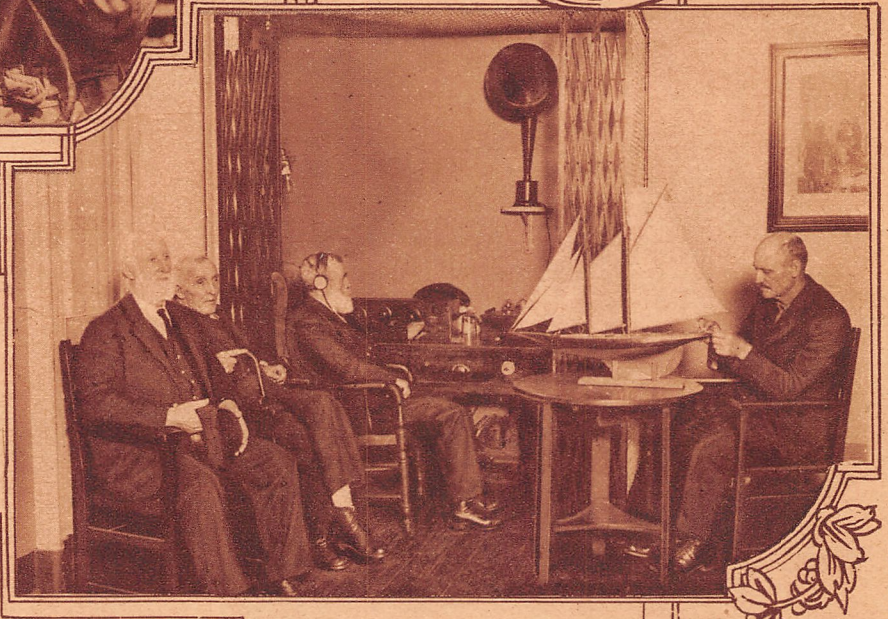




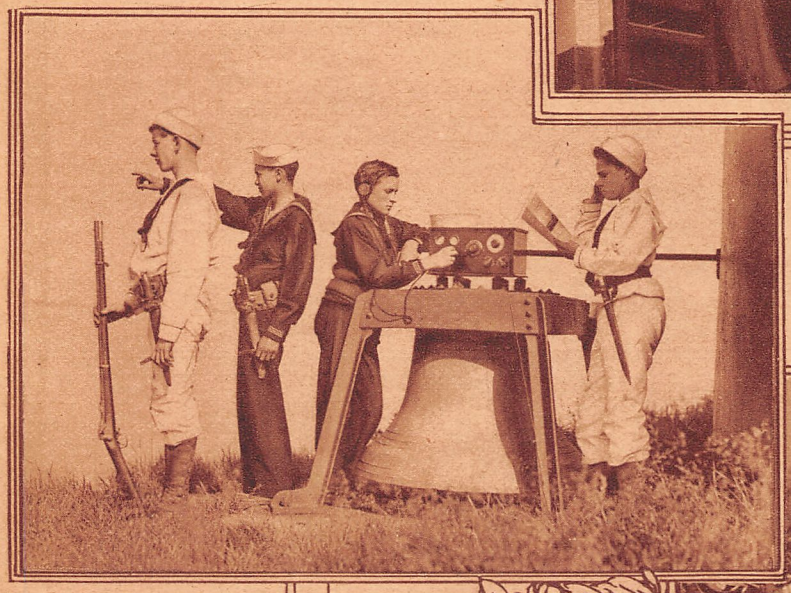
Hark ye fans who would go a'radioing during vacation. A Brooklyn fan simply takes another suit case along and gets the best there is on the air, no matter where he happens to be taking his annual rest. At the extreme left is shown the business end of his extremely compact portable set built in a small suit case. At the immediate left is seen the operating panel presented by the apparatus when ready for operation. © Gilliams Service, N. Y.

Radio Novelties

We have had broadcasting on the top of skyscrapers, from underground antenna, from trans-Atlantic liners and now we have broadcasting from an airplane. Lieut. B. W. Wright of the "Broadcaster," and Lieut. John Bruner, professional pilot, in the photograph to the left, are shown making preliminary tests before their broadcasting flight over Washington, D. C. Their voices were rebroadcast by one of the Washington land stations. With the aid of powerful searchlights the fliers spotted important sections of the country and described the scene as viewed from the air. © International News Reel.



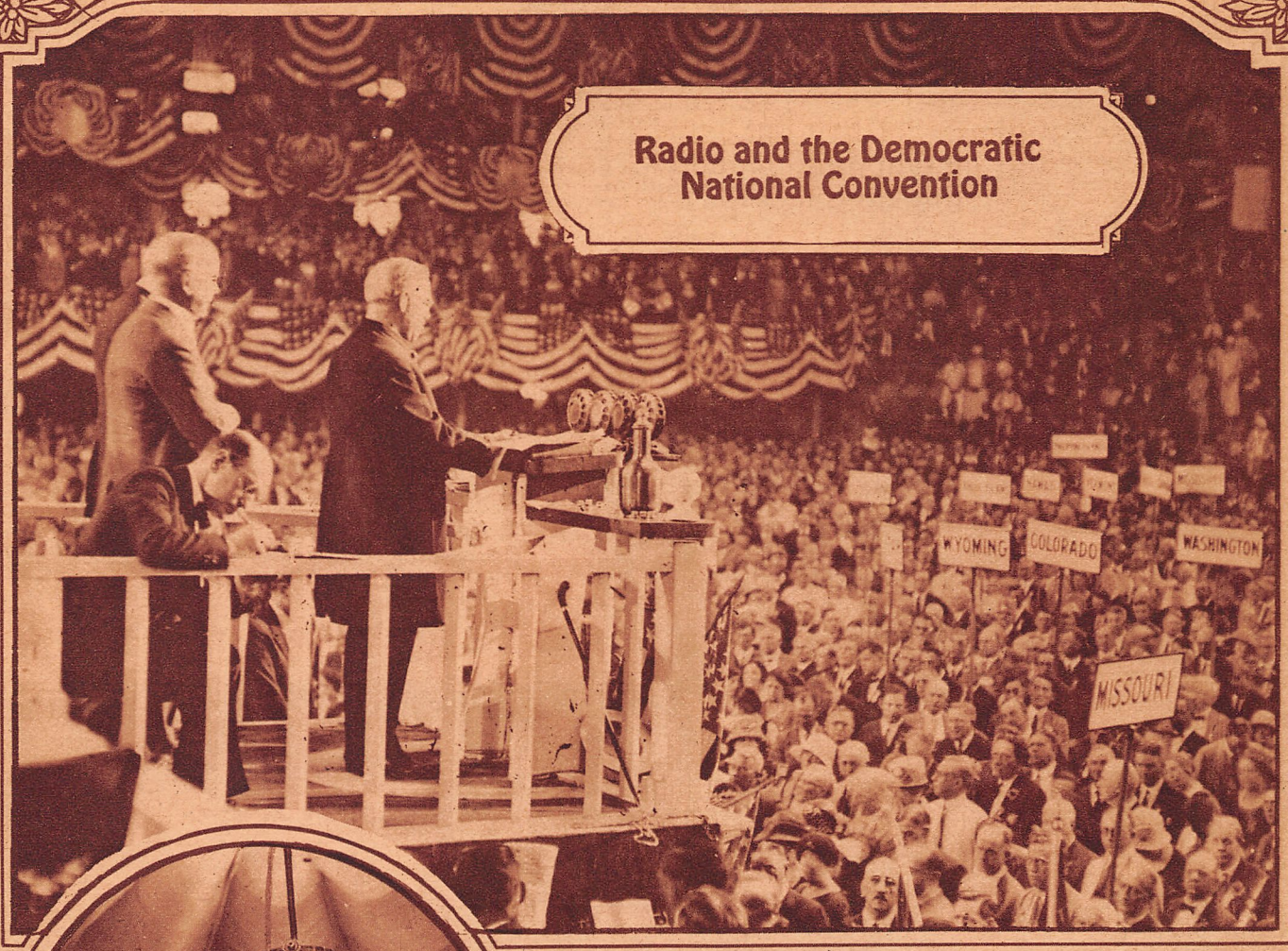
"Not like the old days," say old Salts, with many a stormy journey around the Horn to their credit, as they sit in Snug Harber, New York City, listening to all the latest news and music coming in over the loud speaker, while it rains and blows a gale outside. There was no radio aboard their ships in days when they sent all hands forward to reef the topgallants or to drop an extra anchor to starboard. They are making up for everything now, for all these old sea captains are radio fans. © Kadel and Herbert.



Radio plays an extremely important part in all branches of the Navy. In fact the Navy must depend almost entirely on radio for its communication. So it is easily understood why even in the Junior Naval Reserve every man above the rank of petty officer must know his radio. At the left are some of the members of this branch of America's first line of defense gaining a little code practice in their picturesque encampment at Fort Washington, S. I. © Kadel and Herbert.

Robert Fraser, well known movie star, is an enthusiastic radio fan. He has equipped a corner of his garage with the necessary tools and has built a great many sets in this workshop. He is seen here putting the last touch to a Super-Heterodyne.

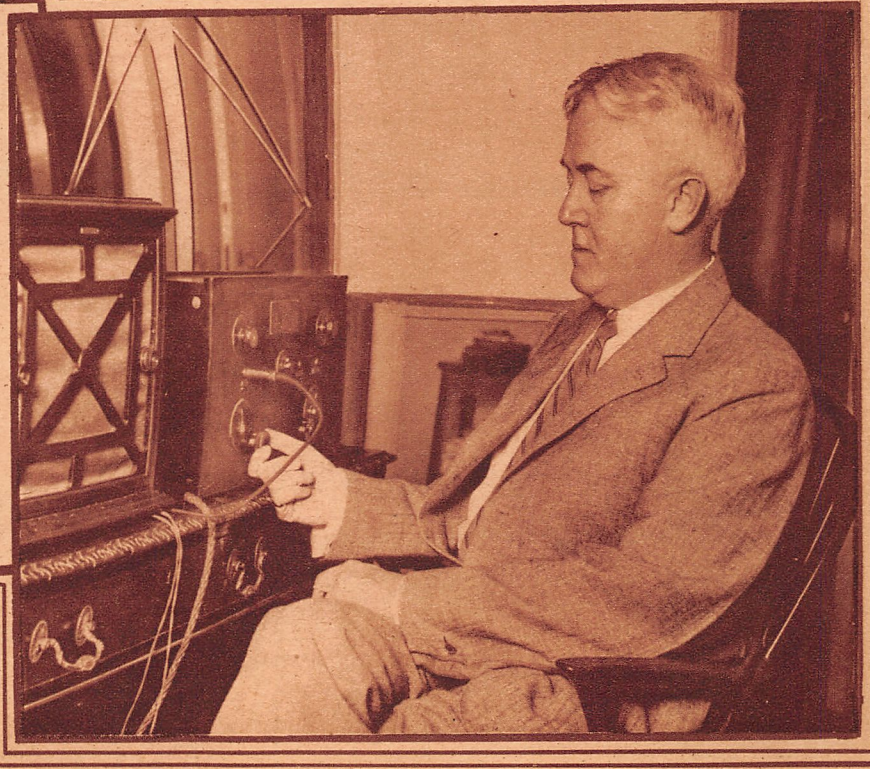
Radio and the Democratic National Convention



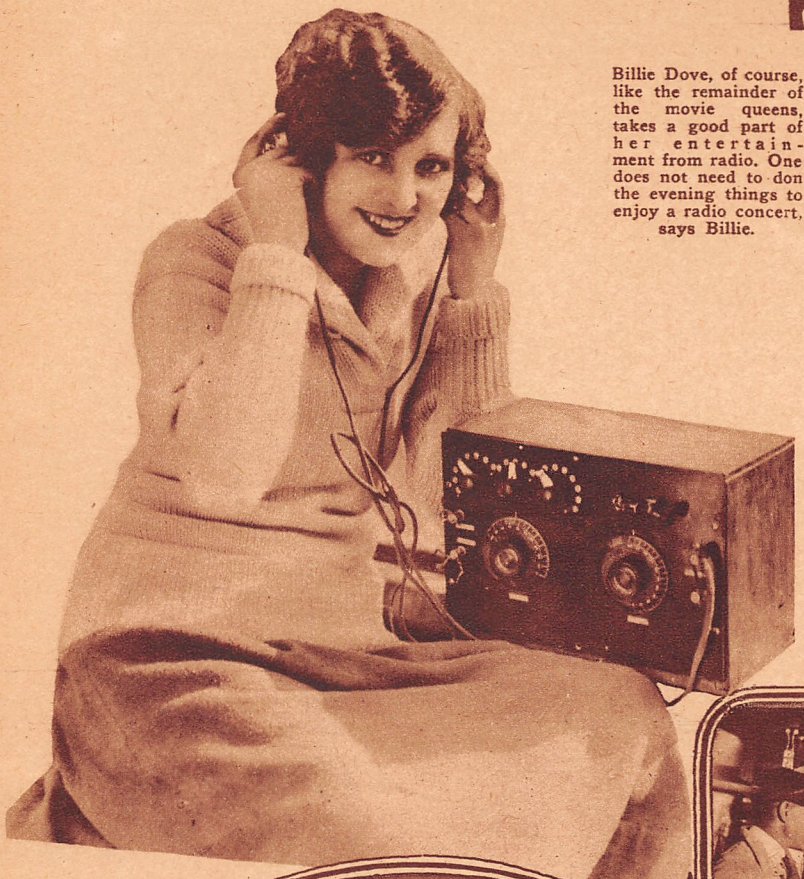
THE far reaching effect radio is going to have on our national politics was recently attested to at the National Democratic Convention held in Madison Square Garden, New York. Millions of people throughout the country, who have never before known the actual workings of the body which nominates the chief executive of their country, were given an extensive peep behind the curtain of national politics. At the left may be seen engineers installing loud speakers which were used to supplement sounding boards in carrying the voice of the speakers to the 10,000 delegates. © Fotograms, N. Y.

Above is Cardinal Hayes opening the Convention with an Invocation. Note the microphones. © Fotograms, N. Y.

Below: J. W. Davis, Democratic nominee for President, is pictured as he listened to his own nomination by radio. © Kadel and Herbert.



Radio Invades



Billie Dove, of course, like the remainder of the movie queens, takes a good part of her entertainment from radio. One does not need to don the evening things to enjoy a radio concert, says Billie.

WHEN movies accept the scientist's work the philosopher's decision is that the scientist's work has at last gained a public. Which is to say, if the movies take an idea, or a machine, or an apparatus, same is known and accepted by the general public as a part of their daily lives. Ergo, radio is one great American institution because there is not a week passes that some enterprising producer does not find a way to work radio into the movies. What is even stronger evidence. Watch closely, the next time you view one of the more pretentious reels and note the radio set found sitting on a console table or in the master's den, simply a part of the picture's property or setting like the window drapes and the kitchen sink. It is the duty of the producer and art director to make his audience place themselves into the role of the hero, if the audience twists dials at home they must twist dials at the movies if they are to enjoy themselves to the utmost. If the hero tunes in WKYZ—and what member of the audience hasn't—the audience will like the picture.

Universal directors use radio to keep the cast quiet while the technical manager completes the arrangement of props and lights.

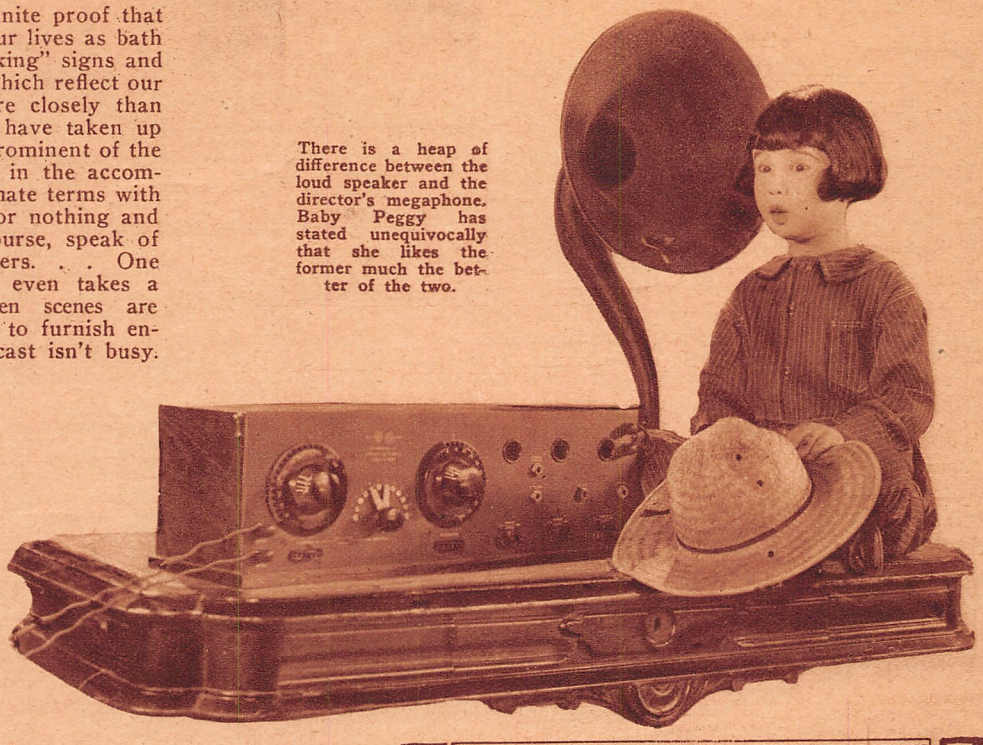
Lew Cody does a bit of broadcasting at a Pacific Coast station. Three mail men succumbed the following day under the load of letters to the station.

Many's the bank president who failed to find the royal road to tuning. The Thousand Dollar movie star is no better than an East Side school boy before the great God Radio. Above: Walter Heirs takes a lesson in tuning.

Pola Negri soon learned the value of American contracts when she came from Europe. Now she seems to have learned the value of another of our institutions. Radio is her playmate.

the Movie Studios

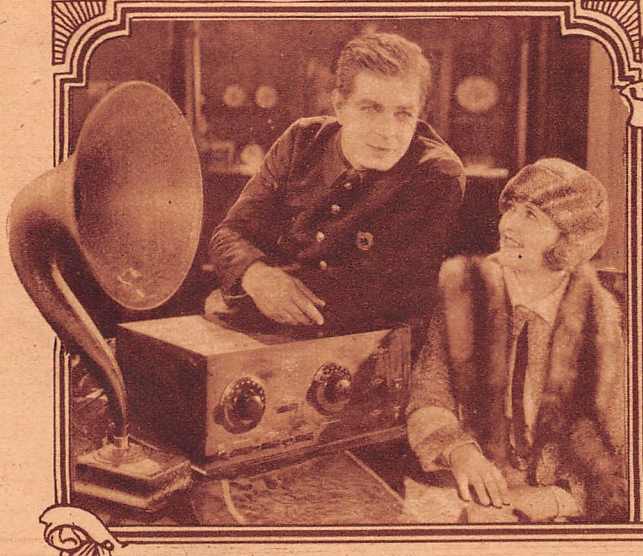
ON these two pages is the definite proof that radio is as much a part of our lives as bath tubs, chewing gum, "no parking" signs and crowded subways. The movies—which reflect our real national character much more closely than even the daily papers—we repeat, have taken up radio. Half a dozen of the most prominent of the silver sheet luminaries are shown in the accompanying photographs to be on intimate terms with the science that gives something for nothing and gets away with it. . . . We, of course, speak of broadcasting and broadcast listeners. . . One of the Famous Players directors even takes a Super-Heterodyne on location when scenes are being taken away from the studio to furnish entertainment and music while the cast isn't busy.



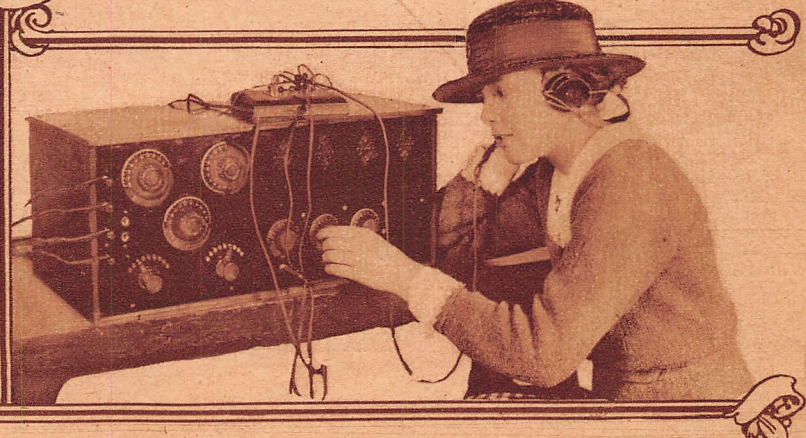
There is a heap of difference between the loud speaker and the director's megaphone. Baby Peggy has stated unequivocally that she likes the former much the better of the two.

Just a snatch of music between sets. Lila Lee is busy and must sandwich her entertainment between work hours.

Miss Naldi finds a symphony orchestra's music (via radio) excellent for making a mood.



There are even times when busting bronchos pales. Vide Hoot Gibson taking recreation from shooting up the town and running away with the sheriff's daughter.



Lois Wilson finds the value of a swift moving tune after a hard morning's canter over country roads.

The Value of Radio to the Deaf

By WARREN POND*

To those of perfect hearing, radio is a mere pastime, something to while away the weary hours, but to those of acquired deafness it is decidedly more than a pastime; it is their only means of hearing the music and the whisperings of the world, formerly closed to them. Read this article by one who, deafened for years, has gained a new interest in life through radio.

I WONDER how many of the five million deaf people who, statistics say, are in the United States, realize what radio will do for them.

From my own knowledge I cannot say what radio will do for those unfortunates who were born deaf, but for those who have, as the doctors express it, acquired deafness, I say, with all there is of me, get a radio—a powerful one—not a one or two tube set.

Let me state my own case: I am 62 years of age, have been deaf since my fifteenth year, and as I grow older my deafness increases. I have been deprived of the pleasure of attending lectures, concerts, theatre, church services; I did attend such occasionally, but was fed on scraps.

A friend suggested radio. I paid little or no attention at first, having learned by hard experience not to put myself in the way of disappointments, but this friend insisted, and finally made an appointment for me to listen in, and to my last hour I will never cease to bless that friend for his "nagging." I heard enough to decide, then and there, to have an outfit of my own—it's a powerful one—five tubes.

I am not ashamed to confess that, when my radio was installed and, sitting in my home, I heard clearly the notes of a song, the tears came to my eyes. After living in the "silent land" for 45 years, the shell was broken, and I found a new Heaven and a new Earth.

I care nothing for the process, mechanical or psychological—I want not reasons, but results, so right here are some of the results.

Last Easter Sunday morning I heard plainly, clearly, distinctly, the first complete church service I have heard in over 40 years—at the West End Presbyterian Church, New York City, from the opening organ voluntary to the benediction (with a stretch of the imagination I could hear the coins drop in the collection plate). In the afternoon the services (Men's Conference) at the Bedford (Brooklyn) branch of the Y. M. C. A. with address by the Rev. Dr. Cadman, and I experienced the greatest thrill of my life when this large body of men—about a thousand were present—sang that gloriously beautiful hymn, "Onward, Christian Soldiers," the music being played by the Gloria Trumpeters. In the evening came a wonderful orchestral concert, ending the happiest, most perfect day of my life with a fine organ recital.

I have heard, off and on, all my life, parts of the Melody in F by Rubinstein, but never the entire composition, until it came to me, over the wire, played as a 'cello solo, the deep bass notes of the instrument sounding like a beautiful pipe organ—the glorious completeness of it!

My nights are entirely devoted to listening in with phones glued to my ears. Recently, I heard a speech by the Hon. David Lloyd George, and it is a simple thing to tune in Pittsburgh, Washington, Chicago, Boston, Detroit and other stations, all of which I hear—in fact I have heard a church service in Pittsburgh very clearly.

The fact I desire to impress on you is this—if, after being deaf for so many years, I can hear services, lectures, concerts, speeches, market reports, jazz and bedtime stories, then others, similarly afflicted, can do the same.

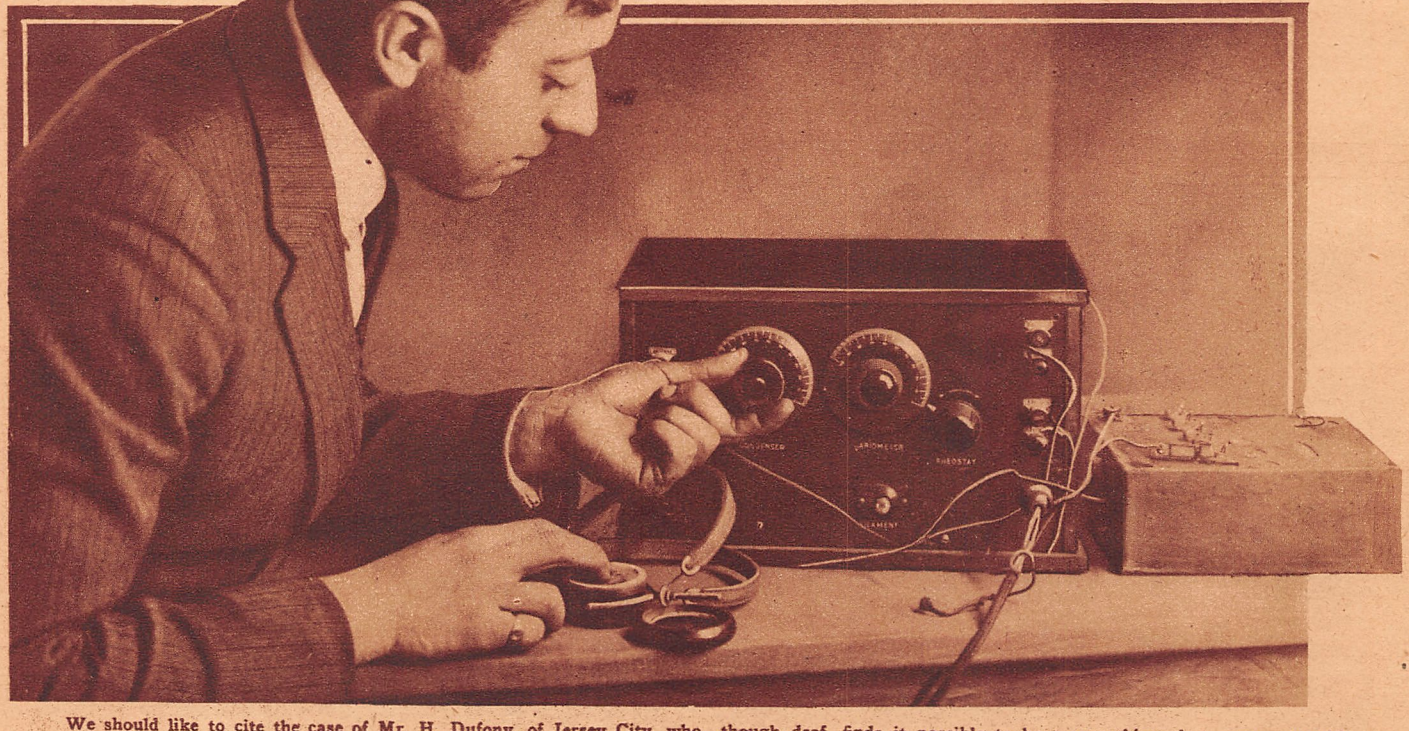
Radio will not cure deafness—it will, however, enable the partially deaf person to hear that which he could not hear in the ordinary way, and it offers a source of happiness far beyond the power of words to express.

I do not wish this article to appear as advertising propaganda, consequently I have purposely omitted mentioning the name of my radio outfit, but to those who are interested, I will, on request, be glad to give full particulars.

As a sequel to my experience came our League radio set—I naturally told other League members about it and one of our directors said at once: "Let's see what we can do about one for the League." What wires were pulled by this irresistible man we do not know, but a few days later I was called to a consultation at the League between several of the Board of Directors and one of the officials of the Radio Corporation of America. This gentleman heard what we wanted; a somewhat difficult problem, for it was essential to accommodate a number of people with varying degrees of deafness.

Then began a series of experiments by the corporation's engineers which lasted well

(*Continued on page* 421)



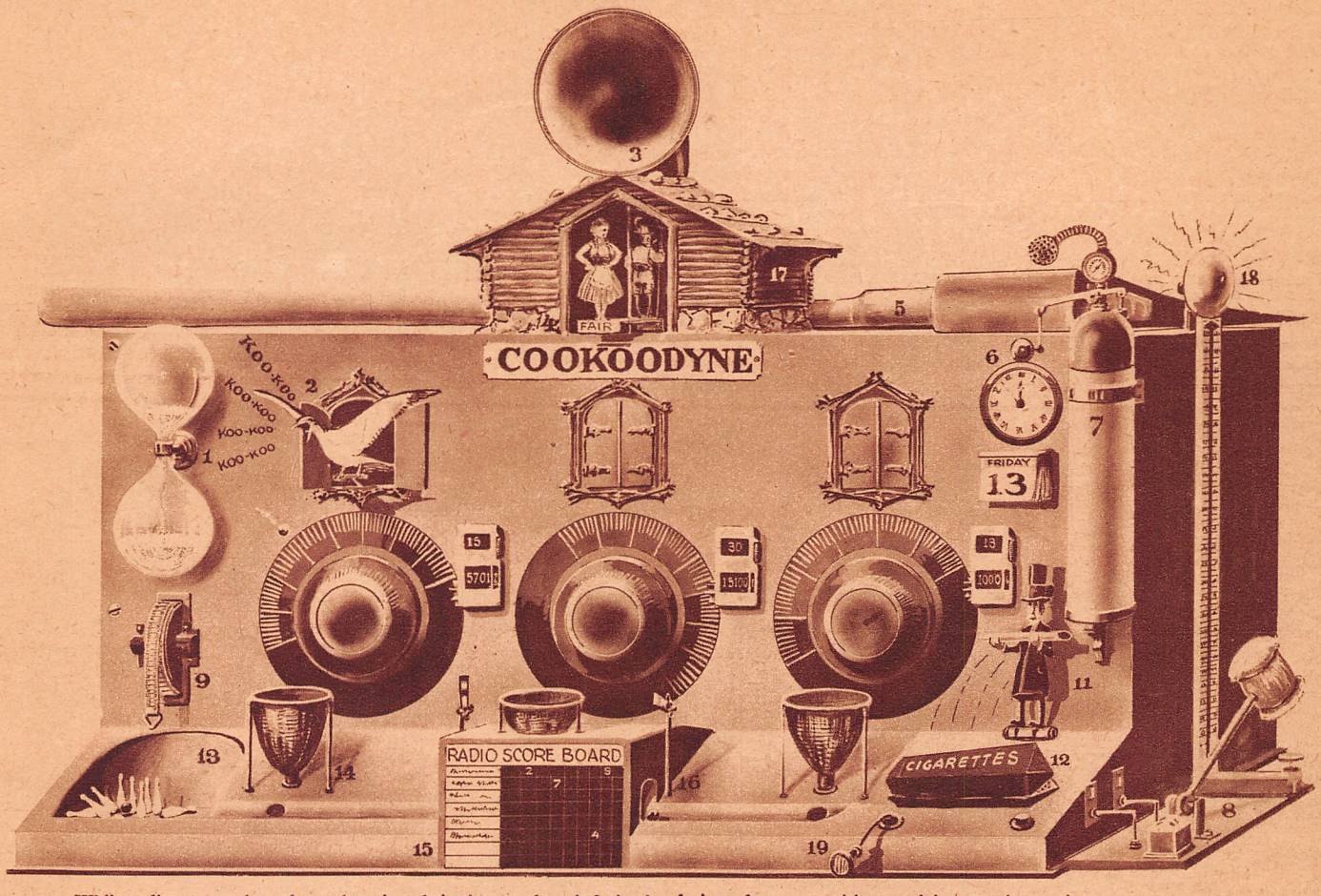
We should like to cite the case of Mr. H. Dufony, of Jersey City, who, though deaf, finds it possible to hear everything that comes over his radio set by unscrewing one of the caps of his phones and lightly touching the diaphragm with his fingers. ©Photonews, N. Y.

*President, New York League for the Hard of Hearing.

The Cookoodyne

By "FIPS"

HEAD OFFICE BOY



While radio experts have been throwing their time to the winds in the design of super-sensitive receiving sets in a vain attempt to satisfy the ever restless radio bug, our own Fips has developed a most exceptional contrivance, the Cookoodyne, as illustrated above. It is minus an umbrella rack and a still, but is otherwise complete. As one expert said concerning this wonder, "the marvelous part of it is that the Cookoodyne typifies the general state of mind of the Radio Public."

THE other morning, when I entered the Chief's sanctum on my daily route of duty, tightening nuts and bolts and exchanging blown out vacuum tubes, I noticed that the boss's countenance was extremely sad. I took courage in my hands and addressed him thuswise: "Your Majesty," said I, "how comes it that you are of such dejected countenance this staticless morning? Has anything happened in radio that should make you sadder than usual, or is it because nothing happens in radio that you are sadder than usual?"

For the first time in many years I detected a gleam of human interest in the Sheik's uppermost left eye. He even condescended to pat me on the head, a thing which he had never attempted before. Normally he bangs me.

"Fips, my boy," said he, "it is true, the radio business is going to the dogs, particularly so in the summer time. People nowadays want to be amused. Not only do they want to be amused, they want also to have excitement. They want a change. Anything that makes for the same routine day in and day out tends to take away interest; thus with radio, particularly in the summer. While it is true that a few million people still twist the dials in hot weather, the majority of them allow cobwebs to accumulate on their outfits when they make a grand dash for the golf links, for the tennis courts, the beaches or the mountains. If we could only get a radio outfit that was so interesting, so exciting that no person could be without it, people would stay home and play with the set, the same as they do during the winter. This is the great trouble with summer radio. It is sad, inexpressively sad, but, alas, true."

Here the All-Highest's voice cracked and he gave a sigh, like that which comes from out the caverns of the thousand winds; he then burst out crying, loudly, and it took my most valiant efforts to recompose the decomposed chief.

This interview with the Emperor left me visibly disturbed. I have been office boy for the last 18 years and while it is true that I have received only 69 raises during that time (one of which was a raise in salary and the other 68 were of a different nature when the Sultan *raised* the devil with me) nevertheless I had sufficient sympathy for him to try and help him out of his troubles. Accordingly, I worked for six days and seven nights along the lines of my recent interview with the Caliph. During this time I neither slept nor ate, with the exception of a few "currant" buns, which, being of an electrical nature, sustained me. On the seventh day, in the morning, my labors had finally come to an end. The outfit which is illustrated on this page was at last finished. I am proud to say that it is a radio such as has never been seen anywhere on this globe. Needless to say, I was proud of my work. I placed the outfit on top of a rubber-wheeled tea wagon which I had borrowed from my mother for the occasion. After knocking three times at the door of the Anointed One's sanctum, I entered. The Czar was just in conference with the rest of the General Staff.

I held up my right hand and said in an impressive voice, *"Behold, the radio wonder of the age."* The Chief, as well as the rest of the Army, looked at my handiwork in blank amazement. Two of the weaker members fainted dead away at the sight of it, but as I had brought along smelling salts, anticipating just such an occurrence, I soon had them all listening to me with rapt interest.

"Gentlemen of the jury," said I, "let me introduce to your Royal Highnesses, the greatest radio invention that ever waved through the ether,—*The Fips Cookoodyne.* After an impressive talk which I had with your King a few days ago, the necessity of inventing a *utility* radio outfit was greatly impressed upon me. I am happy to say to you, my dear Sultan, and to you my dear generals that the problem has been solved with exactitude and completeness. I have striven to produce an apparatus that will keep the most sport-loving sportsman at home. I have introduced the greatest utilities that have ever been attempted on a radio outfit. Let me enumerate all the advantages.

The outfit itself is not a very complex one. It has only 16 tubes and three crystal detectors, but with all of these tubes you will notice there are only three controls. You might ask the reason for so many tubes. Let me impress upon my venerable audience that not all of these tubes are used in the circuit. There are only 11 tubes used at one time, the rest being in reserve; about which I will speak later. Now let us get down to the actual working of the Cookoodyne.

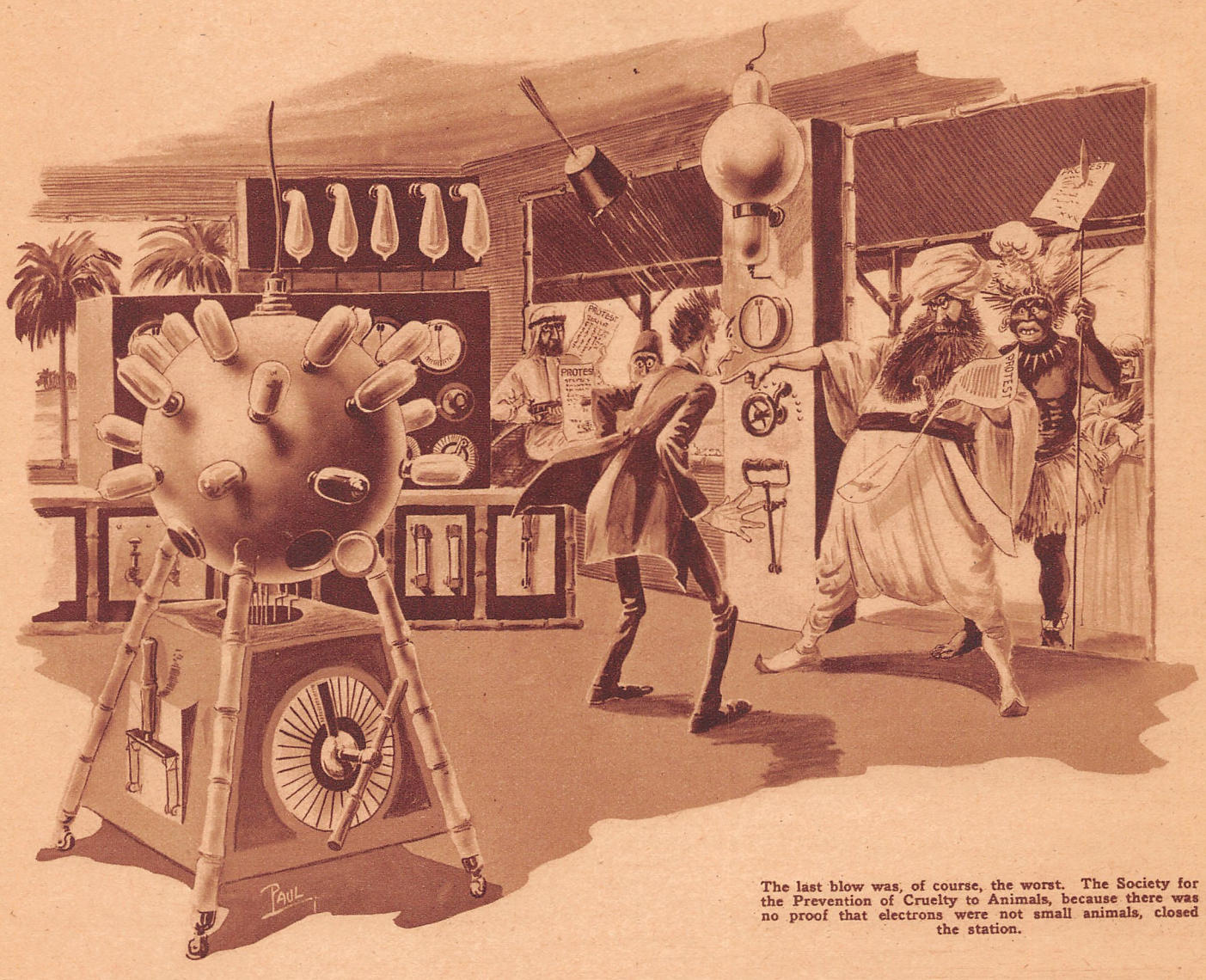
You turn the first tuning dial and if you

(*Continued on page* 408)

Regulate or Bust!

By ELLIS PARKER BUTLER

Author of "Pigs Is Pigs"



The last blow was, of course, the worst. The Society for the Prevention of Cruelty to Animals, because there was no proof that electrons were not small animals, closed the station.

I NOTICE that some new attempts are being made to regulate the radio situation, and that reminds me of my friend Wharton P. Jiggers.

I had not seen Jiggers for thirty years, but a few days ago I happened to be down at the South Brooklyn docks when a steamer arrived, and as I was standing there a most dejected and sad-eyed stowaway poked his head out of one of the portholes, and after he had looked around cautiously he dropped to the dock. He immediately asked me for money to buy food—he said he had been hiding on the vessel ever since it left Africa and that he had not had a thing to eat for a month except a little iron-rust he had scraped off a coil of anchor chain.

I put my hand in my pocket to see if I had anything smaller than a dime, but as I did so I looked at the man's face and it seemed rather familiar to me.

"Look here, friend," I said, "it isn't possible that you are——"

"Jiggers? Yes, sir, I'm Jiggers. And I know why you are asking me that, too. The moment I looked at you I said to myself 'My, but that man looks like Butler!' But I did not like to say so. You are Butler, ain't you? Well, I'm Jiggers, all right. Or all wrong."

So I took him across to a restaurant and gave the poor fellow a good feed, and we talked over the happy boyhood days awhile, and then I asked him how he happened to be so utterly down and out.

"Butler," he said frankly, "I'll tell you. You won't believe me, but I'll tell you the whole story. You remember how I always used to complain of the cold weather out there in Iowa? You remember how I always used to get cold feet, and the sniffles, and was always shivering around? Well, when I was eighteen I decided I would run away from home and go somewhere—go to some place that had a nice warm climate. So I went to Egypt. I went right out to the Desert of Sahara and got a job as camel driver and before long I had saved enough money to buy an oasis. It was a good little oasis, too, with a fine stand of cocoanut palms on it, and I went into the business of raising and shipping cocoanuts, and I made money hand over fist. In a little while I owned six hundred and thirteen oases and I had five or six hundred billion piasteres in the bank—I was a mighty wealthy citizen.

"The only trouble was that it was so blamed lonely on those oases. There was nothing the folks could do, most of the time, but sit there on those little islands in the ocean of sand and wait for the cocoanuts to ripen. It almost broke my heart when I thought how hard that was on those people. So when I sold out and went to Sudania——"

"Hold on a minute!" I said. "That's a new one to me—Sudania. Where is Sudania, and what is it?"

"Caesar's ghost!" Jiggers exclaimed. "Haven't you heard of Sudania? Why, man, Sudania is one of the greatest nations in the world. It's shut in a bit, of course, and it doesn't do much communicating with the outside world because the Ooompahlala Mountains enclose it, but it is just about as big as the United States. They've got a hundred and twenty million population in Sudania, and a government like ours, and big cities, railways, all the modern improvements. They've got sky-scrapers and subways and everything. And it's warm; your feet don't get cold. You must have heard of Sudania."

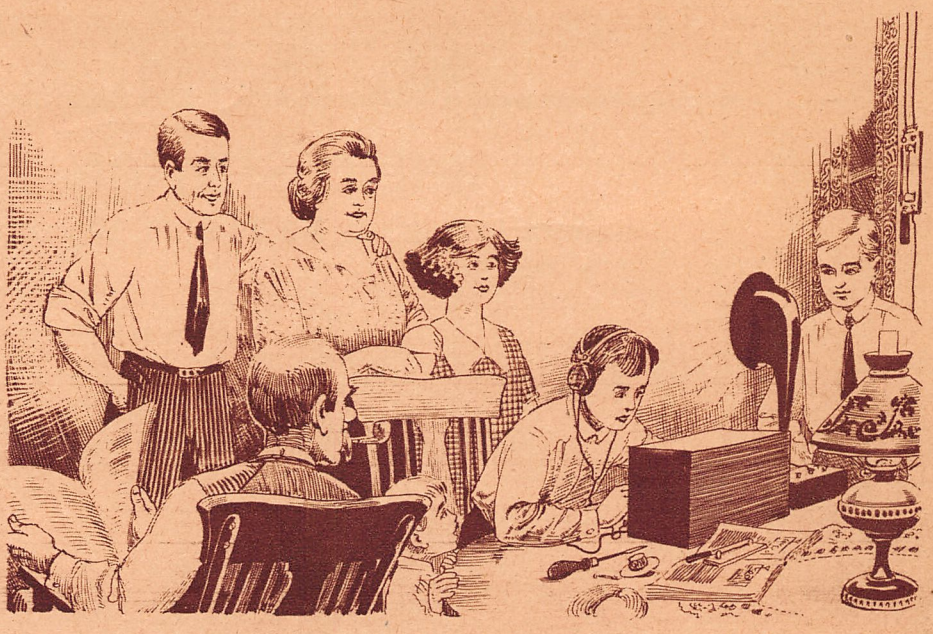
"I think I must have heard of it," I said

(*Continued on page* 416)

Since Willie Made a Hearin' Set

By HARLAN E. BABCOCK

IT used to be at our shebang, when evenin' rolled around,
There'd be a lot a-doin' in the way of home-brewed sound.
When we had et the supper up our ma would call and say,
"Now who will help with 'rettin' up and puttin' things away?"
While sister banged the ivories our pa would read the news,
And on such things as politics and golf would air his views.
Our brother'd play the phonograph and chatter of baseball,
And movies was a subject that we harped on, one and all.
But everything is different now, and more so does it get
Since Willie got the radio craze and made a hearin' set.



There's dust upon the phonograph, piano's closed and mum,
Upon the topics of the day for once our dad is dumb.
Instead of talkin' movies, latest records, dancing, styles,
Our gabbing is of radio that laughs at space and miles,
Of crystals, diaphragms and ohms, cat whiskers and cascades,
Choke coils, acoustic waves and grids, of signaling that fades,
Of choppers, circuits, counterpoise, antenna, coils and vacs.
We argue and we chew until the wall gets hot and cracks!
Oh, things are changed from what they were; we all are glad, you bet.
Since Willie got the radio bug and made a hearin' set.

Ma lets the dishes wash themselves, pa only skims the news.
With voices of the day and night to cheer 'em, what's the use?
So just as soon as evenin' comes we tune the funny thing,
And music plays and stories come and artists joke and sing,
And no one talks, but only grins and listens in, as much
As if to say, "My, ain't this fun, and don't it beat the Dutch!"
Why, who'd a-thought a year ago so soon would come the day
When radio would have the call from Podunk to Bombay?
We're changed at home—I'll tell the world we ain't through changin' yet,
'Cause Willie's goin' to make a new and bigger hearin' set!

Honorable Oscillations

By WILLARD WILSON

To editor of RADIO NEWS, *which induce huge amt. of new ideas and hook-ups into Hams' minds monthly.*

Dearest Sir:

Having became extendedly interested in radio, recent talk concerning sets which make squeal, howl, etc., have deeply shook my interest.

"Practice Hon. golden rule," shout forth all radio papers in husky combat on radiating squealers. "Do not use squealing receiver to others if you do not wish to be squealed at by such also!"

Which are no doubt very nice and true, but also uncomfortable to radio ham which have paid huge sum for exquisite mahogany regenerative howler. Also, such golden rule idea are somewhich unpopular just now. More frequent expression are, "say it with bricks. boards, etc."

Golden rule plan for control of squeal-makers are unlikely to work. Also other plan, of England, who made Hon. law against regenerative receivers. Such law would not work in the U. S. as pepl. would not care whether there are such law or not, which they do in England.

"But," gurgle forth radio papers, "we will tell pepl. many hook-ups which will unregenerate and still produce high-powered DX, etc." But, Sir Ed., is such things going to cure such squeal?

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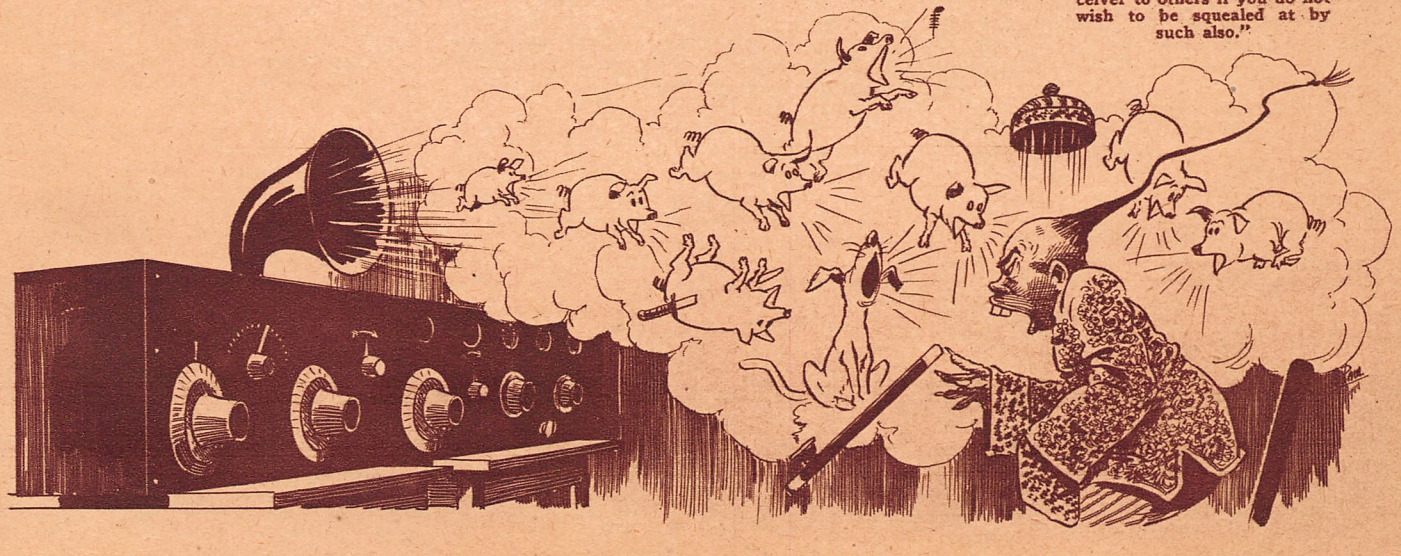
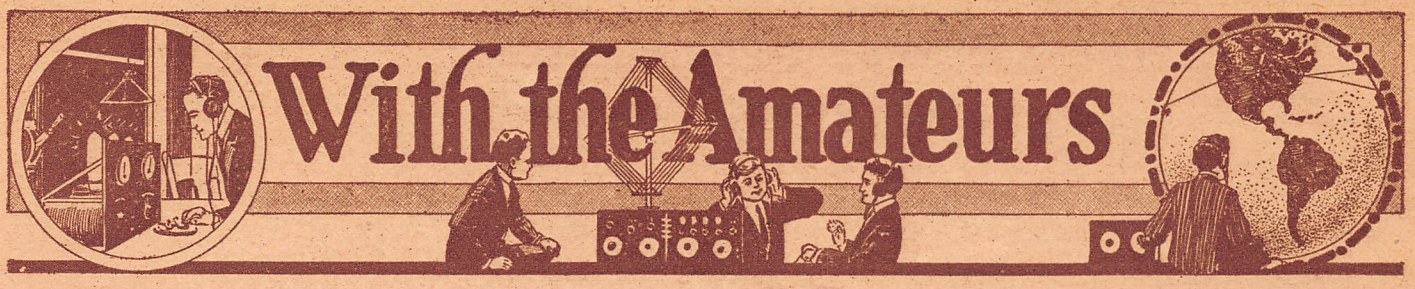
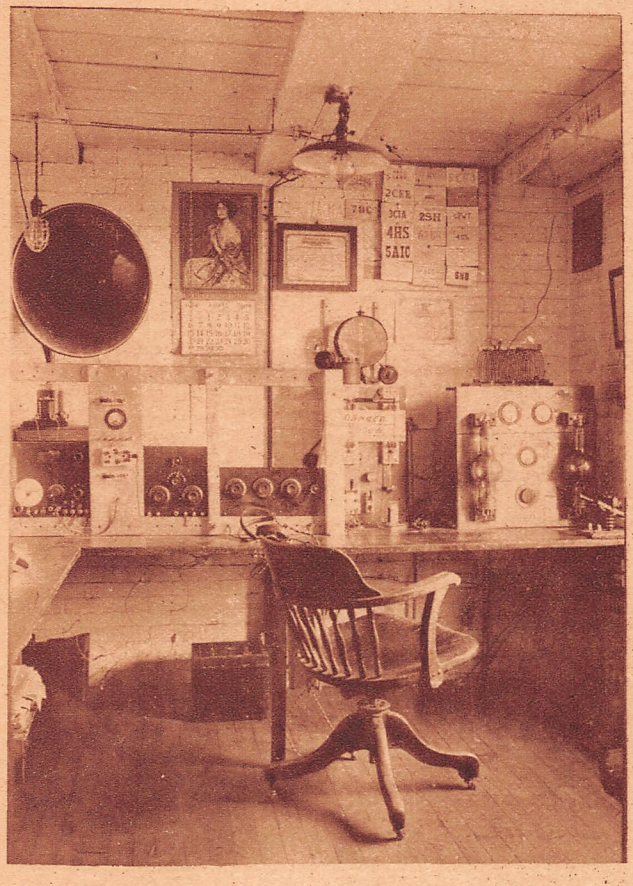


"Do not use squealing receiver to others if you do not wish to be squealed at by such also."



RADIO STATION 1XZ

Clark University Radio Club, Worcester, Mass.



Station 1XZ of the Clark University Radio Club. Signals from 1XZ have been heard in most parts of the world, including New Zealand and Argentina. This station was also in direct touch with Mix (WNP) for some time. There are three receiving sets, as can be seen. The one to the extreme right is a specially constructed low loss receiver for short wave work.

THE success of the station of the Clark University Radio Club during the recent Pan-American tests, conducted under the auspices of the American Radio Relay League, was not due to chance, but rather to the equipment of the station and continuous effort on the part of the operators.

In September, 1923, the club was reorganized and the present equipment installed. The transmitter, conducted by the club, utilizes one 250-watt UV-204 Radiotron in the Hartley circuit. The plate voltage is supplied by a 2-K.W. 2,000-volt Westinghouse motor-generator. This transmitter delivers an antenna circuit of 2.8 amperes at 120 meters, and 5.5 amperes at 180 meters, the normal working waves of the station.

The antenna system consists of a four-wire cage, 75 feet long and 75 feet high in connection with a four-wire fan counterpoise 125 feet long and 20 feet high. The fundamental wave of this system is 172 meters. Special low-loss series condensers are used when the transmitter is operated on the 120-meter wave.

The receiving system comprises three units. Number 1 is a Western Electric long wave receiver, covering a 200 to 3,200 meter wave band. Number 2 is a broadcast receiver, covering 150 to 600 meters. Number 3 is a specially designed low-loss receiver, constructed along lines of recent development in short-wave work. This receiver covers 25 to 220 meters, and is the one used in all amateur and experimental work. Signals from three continents are copied on this receiver. Any of the above sets may be used in conjunction with a two-stage audio frequency amplifying unit.

During the recent Pan-American tests, regular nightly watch was kept by the staff of four licensed operators.

Signals were sent out at regular intervals from midnight to 3:30 a. m., Eastern Standard Time. In addition to the call 1XZ, a five-letter code word was used. For example, "Yokmc" was used on the night that the station was heard in Australia. The station was heard regularly in many South American countries during the tests, and as far as is known, 1XZ is the only station in this country to be heard there using two different waves on the same night.

The station's DX records were not all made during these tests for its signals have been reported repeatedly from New Zealand, Hawaii, Italy, Holland, England and France. Communication is regularly carried on with stations in all parts of the United States, Canada and England. The station was in direct touch with WNP, the *Bowdoin*, Dr. McMillan's vessel, which is in the Arctic, 11 degrees from the North Pole.

On the first night of the Pan-American tests, the station was operated from midnight to 3:30 a. m., E.S.T., with transmission for 15 minutes, a rest period of 15 minutes, etc. The code word "Gojkm" was used, and changes in the wave-length from 120 to 180 meters made alternately every hour. The operator for this night was E. H. Gibbs, also of 1AAC, 1ZO. On this date the signals were reported in Argentina on both wave-lengths.

On May 24, the station was operated by J. L. Peters, also of 1CQK, and was heard in Sydney, Australia, using the code word "Yokmc" and a wave-length of 120 meters. Reception, as reported by cablegram to F. H. Schnell, Traffic Manager of the A.R.R.L., was remarkably good.

The other operators who were successful in transmitting signals heard in South America were: G. R. Gladding, also of 1AOS, and L. A. Goldblatt, former operator in the Navy.

The Clark University Radio Club has 15 active members. The officers during 1923-24 were:

Everett H. Gibbs, President; G. Roger Gladding, Vice-President; Peter Grandone, Secretary, and Walter S. Hanover, Treasurer.

The club also owes much of its success to Dr. Robert H. Goddard, head of the Department of Physics, and to Eugene C. Belknap, Curator of the Department of Chemistry of Clark University.

Hamitorial

ARE YOU PLAYING THE GAME?

THE fall radio season is fast approaching; the BCL is returning from the mountains and the seashore; he is hauling out the old set and dusting it. Soon it will be doing duty again and affording entertainment to thousands, the country over. A big question confronts the entire listening public this year; will they experience the same old annoying sing and buzz of radio telegraph signals breaking through on the broadcast waves? If so, will such interfering signals emanate from amateur, commercial or other sources of radio transmission? The Department of Commerce and the shipping interests have come to an amicable agreement which, if carried out on the part of the latter, will practically eliminate ship interference. Will the BCL then have just cause for complaint against amateur transmitters? It's up to you, fellows—it might be said that your entire radio future depends to a great extent upon the outcome of the relations between your stations and the broadcast receivers during the fall and winter season, 1924-25. Let us analyze the situation a bit, and then determine individually, upon our proper course.

Broadcasting came into its own, over night—its phenomenal growth is a familiar story. But—it came to stay and is with us now in a far more stabilized condition than heretofore. It has become a great force in our communities and will continue as a great public benefactor. The sooner you recognize that, the quicker will you have harmony between yourselves and the listening public.

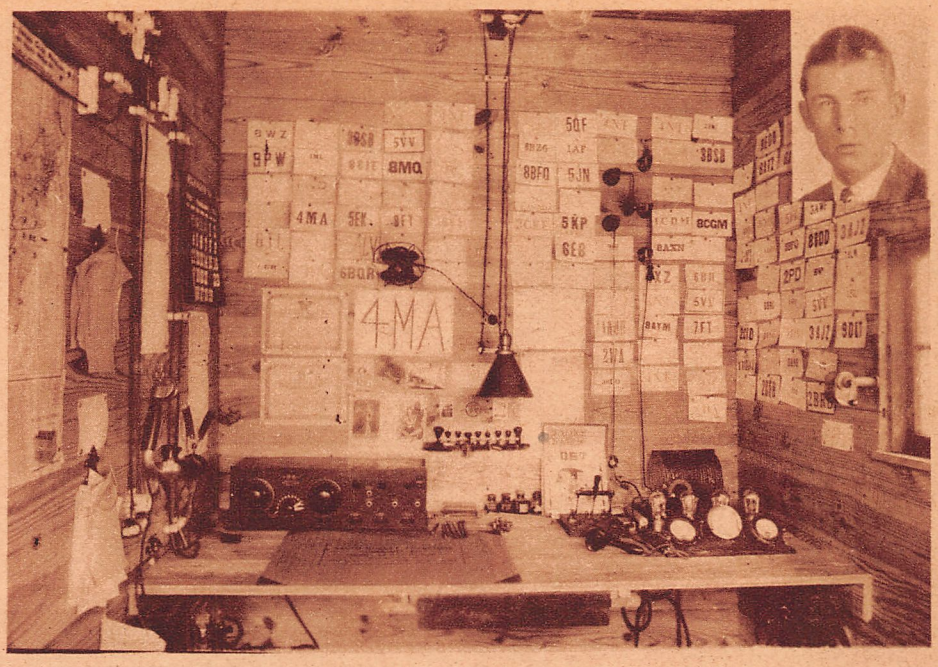
During the winter and spring of 1922-23, an unbelievably chaotic condition existed in the way of interference between amateur transmitting stations and the receiving equipment of the broadcast enthusiast. Thousands of complaints were filed in the various radio inspection districts of the United States Department of Commmerce. Such complaints were far too numerous to be handled individually by the different districts with the limited personnel available. The result was that the broadcast listener, in many

cases, took matters into his own hands and threatened the amateur with dire punishment. This only antagonized the latter still further and caused him to attempt a comeback through creating a persistent interference. This was punishable very heavily as malicious interference, but the Department of Commerce, which has always been your very good friend realizing the chaotic conditions existing and preferring to smooth out the difficulties by local arbitration, did not, to the writer's knowledge, make a single prosecution for malicious interference, although many were justified.

The summer season with its consequent migration to the sea-shore and general slacking up of radio activities was a welcome relief and offered all factions a breathing period. During the hot months, many conferences were held; both Governmental and civic. New regulations were drafted and tentative plans, which appeared as though they might work out very satisfactorily, were arranged.

REGULATIONS TESTED

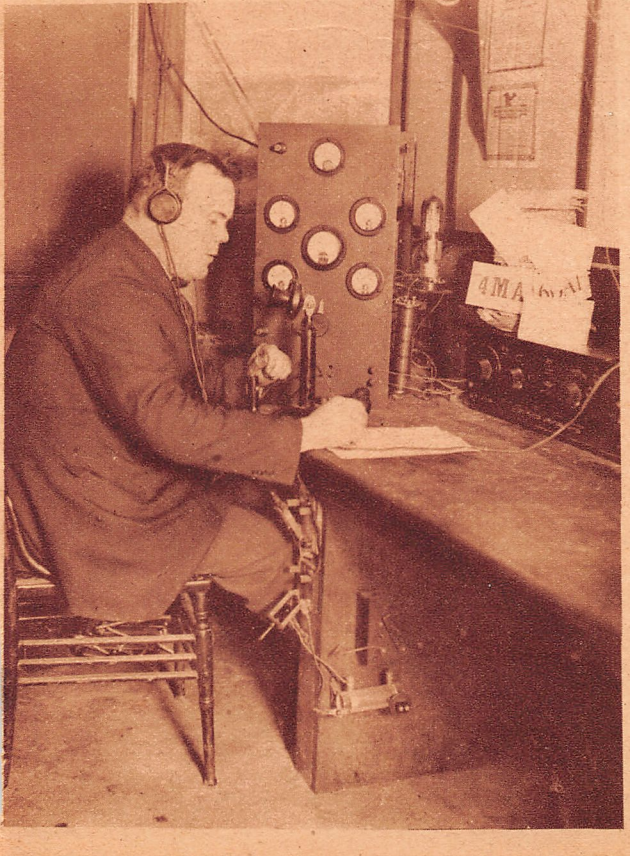
During the early fall, these new regulations were tested against the coming of the real radio season, and they worked out splendidly! There was every reason to believe that with the new frequency assignments on both sides, a division of time between broadcast stations operating on the same frequencies and the inauguration of compulsory quiet hours for amateur stations, almost perfect harmony would result! The first practical tests of the new arrangement have just been completed. We have passed through the radio season of 1923-24 and the improvement over the previous years' conditions was tremendous. Nevertheless, interference was still heavy, but in countless investigations it was established that a large share of the blame attached itself to ships; both American and those of foreign registry. The latter were, of course, out of the jurisdiction of the Department of Commerce, but efforts were made to assure more co-operative operating from our own ships. These were partially successful, the coming of spring with the consequent fading of DX signals, automatically solving the problem temporarily. The marine source of interference is, therefore, of rather doubtful seriousness at this time, but with the coming of the good radio weather again, the situation will require careful watching.



Station 4MA owned and operated by John B. Gray, Jr., Wilson, N. C. The transmitter is a 20-watt C.W. and phone set using the Hartley circuit. A 200-watt, 500-volt R & M motor generator supplies the plate juice. Radiation is 3½ T. C. A. into a six-wire cage aerial and a 30-wire counterpoise. A CR-13 is to take the place of the present CR-9.

We are chiefly concerned with the amateur as a source of interference. In the last year's investigations, all things considered the co-operation from this body was remarkable, considering their numbers. The Supervisor of one of the most densely populated districts estimates that he received 98 per cent. co-operation from the amateurs! This was splendid, but it was not enough! You must co-operate 100 per cent. That isn't a big order, and if you'll only fill it, the BCL cannot legitimately complain of a single amateur, whereas if but a single one fails it will result in complaints from literally hundreds of BCLs!

You are now whipping the old set into shape for the winter; the BCL is back from his vacation and the air is once more to prove itself as a peaceful field of waving corn, or as the same field, trampled to ruin by hostile armies. Fellows, the decision is up to you! You know what your legal wave bands are — the decrement allowed by law is an old story, and the compulsory quiet hours are indelibly stamped upon each of your licenses. This is all very definite—there can be no misunderstanding on your part. The air is yours—free and clear—from 10:30 p. m. until 8 p. m. of the following day. During these hours the BCL will have no reasonable complaint. But he is going to insist on his two and one-half hours every evening and the Department of Commerce is going to back him up, just as it will stand back of you in your lawful operations during the other hours! This applies as well to the local church services on Sunday mornings; a number of you have written requesting the interpretation the Department places upon the "Sunday" clause in your licenses. It is in effect, just this: If you live close enough to any broadcast station which is disseminating religious services, it is your duty to stand-by until the completion of such services. If not in the exact words to make this meaning definite, this is the spirit of the clause.



Station 2EL, Freeport, L. I., owned and operated by Harry H. Carman. With a 50-watt bottle in co-operation with a Grebe CR-13, 2EL has done some excellent work. His sigs. have been heard in England, France and on the west coast many times. Mr. Carman handles a large amount of traffic through his station.
© Fotograms, N. Y.

You must also give a little credit to the BCL for benefits he has brought you. For example, were we to have supported our radio manufacturers, the old "stand-bys," not the "fly-by-nights," only through our amateur activities, we would have waited several years for some of the large variety of new devices which they now offer us.

Obviously, the Department of Commerce Radio Service cannot listen to each of your individual transmissions. Among as large and varied a class as you are, there are bound to be a few "black sheep"—these "got by" before the advent of radio broadcasting; the "gang" didn't care to report them. But now—with thousands of ears listening in in your own neighborhood every night even the occasional offenders will be brought to justice.

This is not written in support of the BCL. His faults are many, but so were yours when you were as green at the game as he is. The writer does not wish to go on record in defense of either side. He is merely interesting himself from fair play. He does not care for a broadcast program, but there are thousands who do, and they have every bit as much right to the enjoyment of such as you have to your own pleasure. You often vehemently state that you are willing to meet the BCL half way—do you know that a strict interpretation of this means that you should give him 12 hours a day?

Can't you, to uphold the glory and honor of the game, give the Department the same assurance that you'll stick strictly to the letter of the law. —*Howard S. Pyle.*

(*Amateur section continued on page* 424)

Amateurs Link New Zealand and Argentina

Señor Braggio and his son who together work station CB8. They have spent considerable time and labor on the installation and improvement of both transmitter and receiver. Their recent record has well rewarded them.

ARGENTINA TO NEW ZEALAND

By CB8

STATION CB8 is owned by Mr. Carlos Braggio, of Buenos Aires, South America, who recently worked a New Zealand amateur with his 100-watt transmitter. The C.W. transmitter uses four 50-watt tubes which may also be used for telephony on a wave-length of 300 meters. So far, the record of this station is 1,500 miles on telephony and 2,400 miles in telegraphy. For the Pan-American test, Mr. Braggio constructed a special vertical cage antenna with counterpoise which gave excellent results. The antenna is 100 feet high supported by a wooden tower erected as close to the station as posible.

The whole station has been installed and is operated by his son and himself, and consists of the transmitter described previously, which they often work on 120 meters with a radiation of 5 amperes and a short wave receiver tuning from 60 to 250 meters. This short wave receiver is entirely homemade and consists of a detector and one stage of audio frequency. During the tests carried out recently, they received 50 amateur stations from the United States. The following is a part of their log showing how communication with station 2AC of New Zealand was carried out.

—2AC New Zealand your signs QSA.
—Very pleased to receive your answer this being a good record—Congratulations.
—Thanks, congratulations QRA.
—My name Carlos Braggio Calle Alsina No. 412 Buenos Aires—give your name and address I will send u a cable.
—Your sigs much btr nw my name is Ivan Omeara, Gisborne, New Zealand.
—Your signs vary—Very glad. You have now a new friend here—I will call you tomorrow at seven Greenwich time. We have had weather QRN. It is raining—Congratulations again—Here is 5:45 a. m. G. M. till tomorrow.
—Time here now 9:15 p. m. al rite seven tomorrow ta ta—is it daylight you yet?
—No it is dawning—Strong QRN—GM till tomorrow.

American stations 6CGW, 9ZT and IXW are received very loud on the detector alone and they receive a great many stations between 160 and 180 meters. Following is a list of calls heard during the test:

May 20-21

12:40 1XW calling CB8.
1:05 1XAM—Joe sleepy nw. om.
1:20 1XZ of NW South America JOC NW.

May 21-22

12:30 1AR calling CQ.
12:35 1AR calling 1BQ.
12:40 1BQ calling 1AR.
12:43 3ADB calling CQ.
12:45 1BQ—wife told—when goes to leave for—? and how long time—Boston—QSB?
12:48 1XZ calling 1BQ BSG QTC?
1:00 8BPA test.
1:40 1XZ test GOJKM. (This station was heard simultaneously on 120 and 180 meters. The short wave much stronger.)
2:00 9UA CQ.
2:30 3OH CQ.
2:45 4BSAT or 9BSAT (178 meters).
3:10 4IZ CQ.
3:15 4IZ calling 9CJM.
3:25 1ABF test South America BKNF.
3:30 1AW CQ.

May 23-24

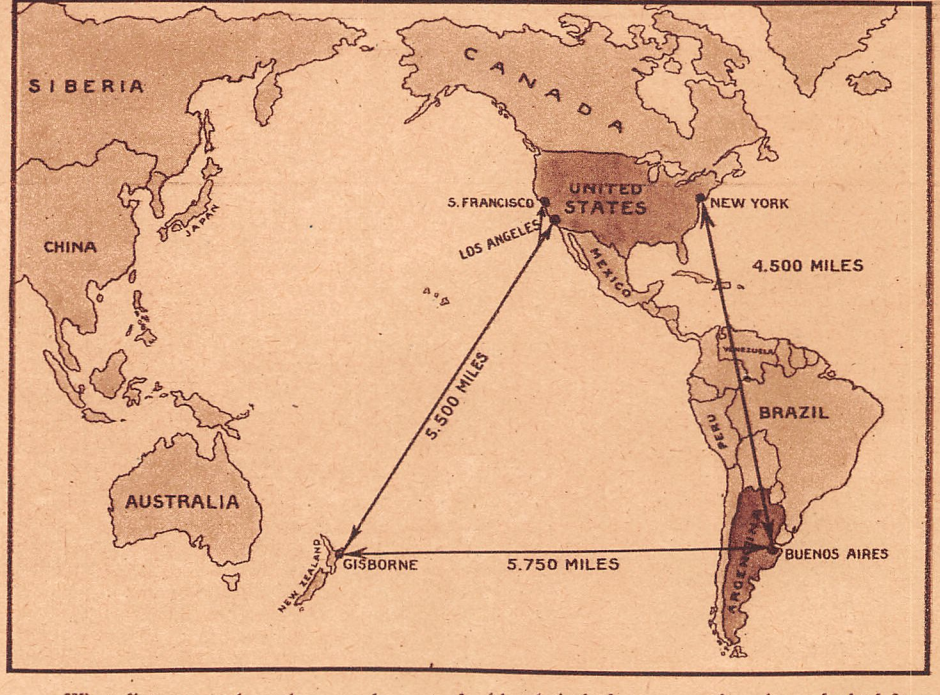
1:40 1BCR test South America MOA GW.
2:15 9UA CQ.
2:30 1CPN calling CB8 (answered without reply).
2:50 1CPN calling 6CGW—here N. 1 from 1CPN to 4AA NZ—enx for crd—wl grx for a friday saturday sunday nite and listen for u on superhet on 170 meters—sig 1CPN.
3:00 3YO CQ
3:10 4IZ u test FRAY
3:12 6CGW CQ.
3:50 4CB CQ.
4:45 9ZT calling 6CGW.

May 24-25

12:40 2XI test would like communicate with station below 150 meters—QSA. (answered without reply).
1:15 2XI calling 8BW.
1:20 8CYI CQ.
1:53 9AIM calling 9PW.
1:55 9CCS CQ.
3:00 3CKJ CQ.
3:05 8BCP CQ.
3:08 6CGW CQ.
3:15 1BIE CQ.
3:20 9ZT CQ.
3:25 8CYI calling CQ 6 disk.
3:40 5MI CQ.
3:45 4IZ calling BX MU.
4:00 6AMK CQ.
4:55 4IZ calling 5AIL.
5:05 4BNU CQ.

May 29-30

1:15 1XW test South America MARGO.
1:30 1XW fm Hartford, Conn., U. S. A. 112 meters.
2:00 8XBJ dec u.
2:05 4CR CQ.
2:33 1BIE CQ.



When distances such as these can be covered with relatively low power, there is no doubt left that the near future will bring round-the-world radio relay. Mr. O'Meara in Gisborne and Mr. Braggio in Buenos Aires have communicated with the States, as well as linking up New Zealand and the Argentine.

3:25 5OQ calling 6APW.
3:40 1ABF calling 6APW.
3:42 1BIE CQ.
3:44 6APW CQ.
3:58 9CJM CQ.
5:15 3BWJ calling CB8 (answered).
5:25 3BWJ calling again CB8.
5:28 CB8 replied G. M. Greetings and congratulations. QRZ QRK?
5:32 3BWJ again calls CB8 but signals weakened till they gradually disappeared as the sun was rising there.

May 30-31

3:17 1XAK CQ.
3:22 4IZ test DANZ.
3:28 8YN CQ.
3:45 1XZ test N. 1, from 1XZ, to Revista Telegrafica calle Peru 115 Buenos Aires. Congratulations on Pan-American tests—heard here.
4:40 8AAJ CQ.
4:50 1GV CQ.
4:53 1BVL CQ.
4:55 IBIE CQ.
4:58 1BOQ CQ.
5:15 1XW calling CB8 (answered during 10 mins. without reply).
5:29 8ZW CQ.
5:30 4IZ calling 8ZW.
5:35 5AIR calling 4IZ.

May 31-June 1

2:10 4TTR CQ (4CR?).
2:25 3AQ calling 9AYD.
2:50 1XU CU 4CR.
2:50 6CGW CQ.
2:53 4AF CQ.
5:00 1XW CQ.
5:14 6AJA CQ.
5:20 9ZT CQ.
5:30 9ZT calling 6GT—here m from 9ADG to 7ADM—did u ever gem the cards I sent? sig 9ADG.
6:15 6CGW CQ.

Broadcast stations heard at station CB8—KDKA, KFKX, WJAX, WGY, WEAF, KFKB, WBZ, KPO, KGO, WOC, 8XS, 2XO.

NEW ZEALAND TO ARGENTINA

By Z-2AC

THE reception of American amateur signals in New Zealand is a nightly occurrence, and for some time it has been the dream of our foremost amateurs to complete the communication both ways with our cousins across the Pacific.

To this end several tests have been carried out recently, and while test messages were copied in New Zealand from prominent amateurs in the United States, our signals, for some reason, have not been received. The last test was with U-6PL on 120 meters but after a week's trial it was considered a hopeless task and abandoned.

Mr. Ivan H. O'Meara, better known in amateur radio circles as Z-2AC, who recently carried on fairly consistent communication with station CB8 in Buenos Aires.

We usually hear most American stations in the early hours of the evening, and it was while searching for my old friend U-6CGW at 7 p. m. on May 22 I heard a station calling CQ R-CB8 on about 118 meters. I could not remember what country the letter R represented, and was puzzled over his identity, especially as the number followed after his call letters.

Station Z-2AC owned and operated by Ivan H. O'Meara, the New Zealand amateur who bridged the gap between his station and that of Mr. Braggio in South America.

As his signals were of good strength despite the QRN, I imagined him to be perhaps 1,000 miles away, and thought it a good opportunity to try out my short wave (125 meters), so I called R-CB8 for five minutes at 7:20 p. m. with a radiation of 2.5 amperes and input of 165 milliamperes at 900 volts. At 7:30 p. m. I was quite elated to hear him call Z-2AC R-CB8 and say "GM your sigs QSA." He called again and after his call letters said "from Buenos Aires—Very pleased to have received your answer—this being a good record—Congratulations. My name Carlos Braggio, Calle Alsina DF (r?) 412 (also spelled the number) Buenos Aires."

When he mentioned Buenos Aires I received the surprise of my radio life, and after recovering from the shock, gave him QSL for msg nr1, my congratulations, also my name and address. Thinking he might be QSO USA, I gave him a message to U-6CGW. He replied "R your nr1 OK but missed your name and address. I want to send you cable PSE rpt name and address . . ." (lost the rest of the message through QRM from howling valve).

His signals were not so loud as at first and QRN was strong, so I asked him for repeat after work "Again" CB8 replied "Your sigs vary now—please rpt again ur name address," which I did several times and asked for QSL. All I received of his reply was ". . . wrd before Gisborne-Ga want address now pse." Again repeated name and address for few minutes CB8 replied with "QRN bad here wl try tomorrow morning. Will call you tomorrow seven gmt sorry but impossible to receive, QRN." Had another try with name and address and received the reply "QRN but will try last time receive your address rpt address."

His signals were much stronger this time (QSA) so gave him repeat several times and asked him QSL. CB8 replied with "RR CK RR TKS Mr. Ivan O'Meara, Gisborne very glad—you have one friend more—well time 5:45 a. m. (9:15 New Zealand time) wl call tomorrow I call at seven—(GMT?) GN" asked him if he meant 7 p. m. my time and received "R. 7 GMT GM GM." I concluded, therefore, that he wanted to break off communication, but noticing the time stated in his previous message, I was eager to continue till daylight, so asked him if it was daylight with him yet and QRK? To which he replied "RR. It is dawning—Your sigs QSA. Well GM till tmw." His signals seemed to be much stronger this time, also less QRN. I then gave him QSL and thus ended the greatest event in my radio career. In the early afternoon of next day, Friday, I received a cable from Mr. Braggio as follows: "Hearty congratulations your radio record," to which I replied offering him my congratulations. As arranged, I was on the job at 7 GMT Friday (6:30 p. m.) but after two hours hard work calling and listening for CB8, I was unsuccessful. However, as the usual American amateurs were not to be heard I was not at all dismayed with my failure to connect with him.

Saturday night was also a blank, but at 7:45 p. m. Sunday, I heard CB8 calling CQ UR CB8 and answered him, but he did not hear me. Again on Monday at 7:55 p. m. I heard him call ARRL UR CB8, so had another shot at him, but was still unlucky and was beginning to think I would never connect with him again. On Tuesday evening from 7:30 p. m. to 7:58 p. m., CB8 was still calling ARRL; I answered him for six minutes and was overjoyed to hear him call me (8:06 p. m.) and say "GN weather very bad QRN difficult receive." Tried to tell him I would listen in for him 6 GMT next day, but he replied "GN weather bad QRN difficult receive QRS." I gave him the same message as before, very slowly and steadily and received his answer "NG, QRN, difficult receive. Please call long. Will try better receiver." Then called for several minutes and he replied "Your sigs vary. I received you on two tubes QRN. I use 200 watts, QRN, impossible receive. Will call tomorrow 8 GMT. Congratulations again. Till tomorrow 8 GMT. GN." Gave him QSL and closed down.

It was raining hard and blowing a gale here, in fact we nearly had a flood, and as everything in my radio shack was damp, I considered it remarkable that he should hear my signals on such a bad night. Owing to a breakdown in my transmitter condensers due to moisture, I was unable to work him as arranged, although I could hear him. QSA, but trusted to be in touch with him again during the week.

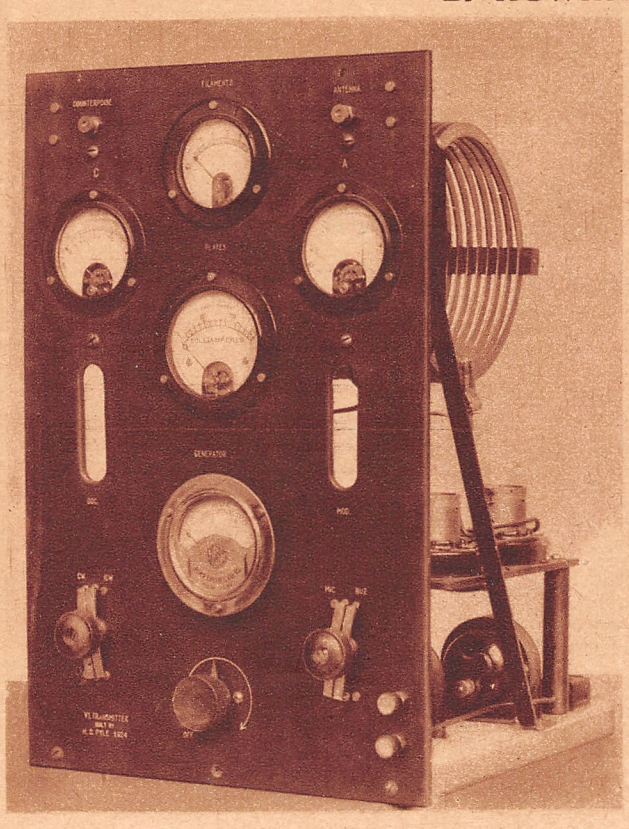
THE TRANSMITTER

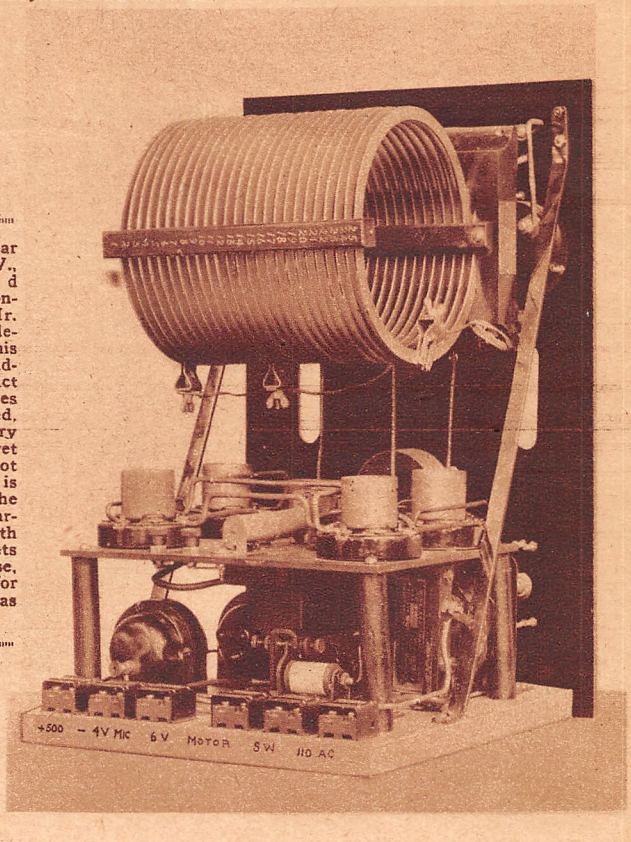
My transmitter consists of the following: Circuit—Series Hartley with separate tuned grid coil (1DH circuit).

(*Continued on page* 400)

An Ideal Amateur Transmitter

By HOWARD S. PYLE, A.M.I.R.E.





A front and rear view of the C.W., I.C.W. and phone set constructed by Mr. Pyle and described in this article. Considering the fact that four tubes are employed, this is a very compact set, yet the parts are not crowded. This is so because of the "double deck" arrangement with the VT sockets on a sub-base, which make for short leads as well.

FOLLOWING the writer's article in a recent issue of RADIO NEWS, covering the subject of the proper design of panel transmitters, a flood of letters was received requesting more definite information on laying out a medium power panel transmitting unit to permit the use of C.W., I.C.W. or radio telephone, at will. In response to this request, the writer presents herewith photos and constructional data covering his own transmitter, used at amateur station 8FT, Plymouth, Michigan.

Four 5-watt tubes are used, the WE type VT-2 being preferred. Using pure continuous wave telegraphy, all four tubes are connected in the familiar parallel arrangement, while in the connection for voice transmission or buzzer modulation, two tubes serve as oscillators and two as modulators. A glance at the circuit arrangement will show it to be of the conventional type, which needs no discussion. A panel 12 by 18 inches cut from quarter-inch bakelite comprises the face of the unit. A baseboard of three-quarter inch oak, 11 by 12 inches, is secured to the front panel by three large wood screws and is braced by two brass angles. This provides a rigid mounting for the instruments.

The tube sockets are supported on a seven by eight inch shelf of three-sixteenths inch bakelite which also serves to mount the grid-leak and the plate and grid condensers. A resistance unit for the generator voltmeter is hung under the shelf, which is supported four inches above the baseboard by four brass machine screws passing through hard rubber tubing at each corner.

A filament voltmeter, plate milliammeter, D.C. voltmeter (plate circuit) and two thermo-couple radio frequency ammeters indicate the proper functioning of the various circuits. The use of two R.F. ammeters in the radiating circuit enables tuning to greater efficiency by bringing the antenna and counterpoise system into balance.

A suitable filament rheostat of proper carrying capacity could not be found to fit the space available, consequently, two power rheostats were slightly remodeled and operate in parallel on the same shaft. A small relay key is provided which breaks the grid circuit, it being considered advisable to carry no R.F. leads beyond the panel. The relay is operated from the conventional Morse hand key.

All connections to outside sources are brought to small connection blocks provided on the rear of the base. This brings all leads to a central panel and keeps them from the panel face.

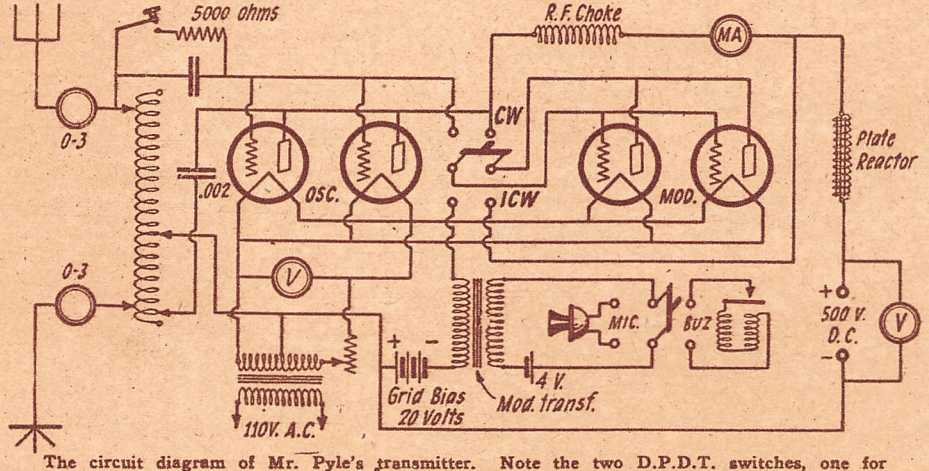
Two binding posts are provided in the lower right-hand corner of the front panel for the microphone, which is a desk type.

CHANGE-OVER DEVICES

Change from C.W. to I.C.W. is effected by simply throwing a small series parallel switch at the lower left of the panel, while voice or buzzer modulation may be selected on a similar switch in the lower right-hand corner. Buzzer modulation was adopted, in spite of some objectionable features, inasmuch as it is designed to carry on merely occasional local work where phone is undesirable, and provides a means of complying with the government requirement for a reduction in power for short distance work.

An angle-iron frame of small stock serves to support quarter inch mesh screening forming a box about the entire transmitter. This is coated with black enamel and in addition to adding greatly to the appearance of the unit, serves to protect the instruments from accidental damage while allowing excellent air circulation about the tubes. The writer cannot urge too strongly that a similar frame or a cabinet provided with ample ventilation openings be placed about the transmitter. It presents a much neater aspect and gives the set a "commercial" appearance, as well as acting as a

(Continued on page 408)



The circuit diagram of Mr. Pyle's transmitter. Note the two D.P.D.T. switches, one for changing from C.W. to I.C.W. and the other for changing from I.C.W. to phone. When thrown to the C.W. position all four tubes function as oscillators.

Loop Transmission Experiments

By L. W. HATRY, 5XU

Here is some real good dope on loop transmission, and from the pen of Mr. Hatry. There is no theorizing in this article. He has given you the results of over six months of experimentation in a condensed, yet complete form.

I DO not choose, this time, to end this article with my conclusions; instead I will put them in the first paragraph, where they will be handy if you wish to find them again. One of the things that has always perturbed me about technical or other articles is that I must always rustle a few dozen pages and hunt through a wilderness of ads. if I desire to make sure of my memory of the writers' conclusions; all because they have inevitably put them at the end of their articles. My conclusions are these: The loop antenna transmitter is good if conditions are such that it will help you to make the most of them, or if you intend to put your signals through in one direction. Otherwise don't fool with it.

By the way, the word loop in this case does not mean the ordinary type of oversize coil; instead, I made a regular open end aerial into a large single turn loop standing about 50 feet above the ground at its maximum.

The first arrangement was simple (as are those that follow) and is illustrated in general in Fig. 2, while Fig. 1 gives an idea of the original aerial. As mentioned above, the peak of the loop was 50 feet from the ground. The transmitter used to excite it was the usual type of reversed feedback set delivering two and one-half amperes to the regular antenna and about two and four-fifths to the loop, from three UV-202 tubes and 500 volts D.C. Fig. 2b gives the equivalent electrical diagram of the loop which is useful in analysis. The condenser C was a .00025 mfd. fixed mica with a 10,000-volt rating and good for several amperes. The loop had, of course, a higher fundamental than the original antenna, the increase in my case being about 50 per cent.

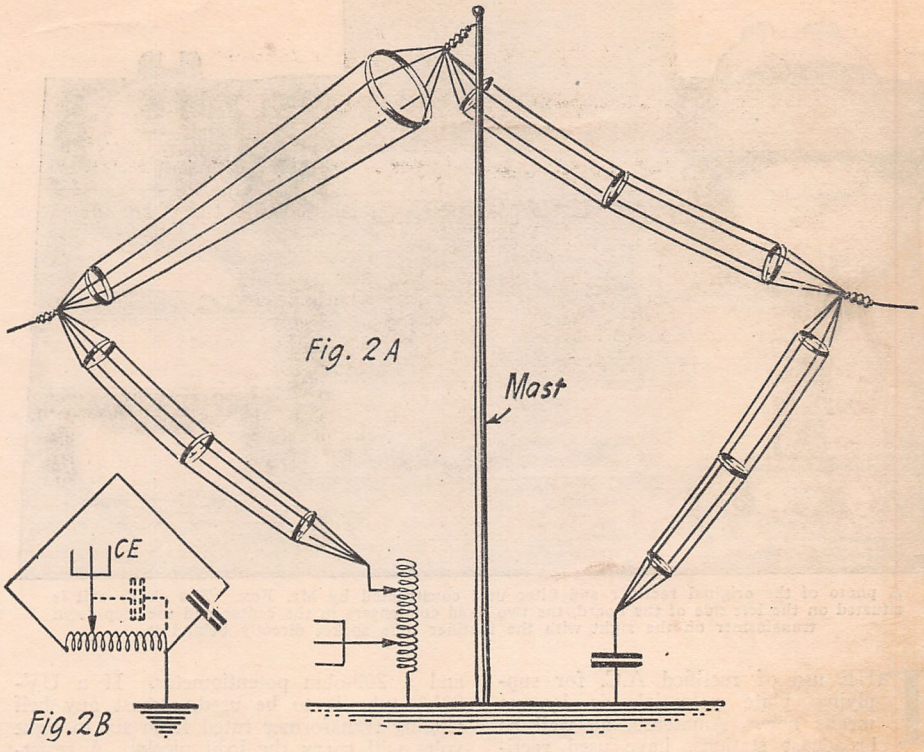
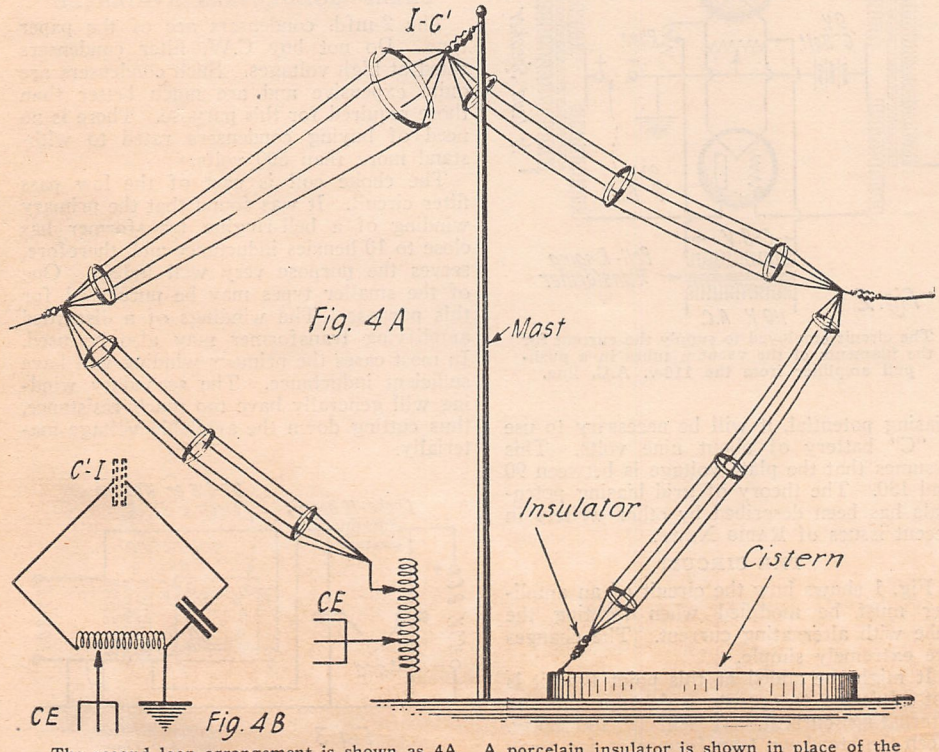


Fig. 2A shows the first transmitting loop employed. The series ground condenser is of .00025 mfd. Fig. 2B illustrates the schematic diagram of the loop and connections.

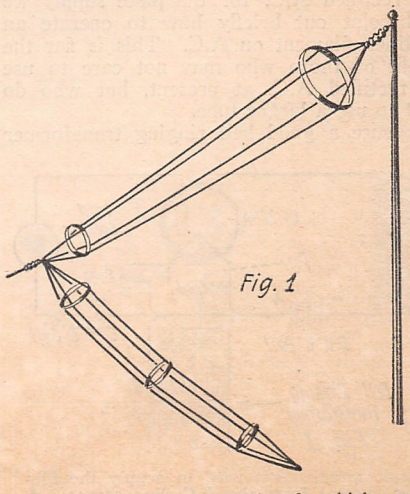
SOME RESULTS

Directional effects of this loop arrangement were immediately noticeable. Look at Fig. 3. You will see from the line AOB and the compass the direction in which the loop tended, AOB representing a bird's-eye view of the arrangement. AO is the original aerial portion and OB the added section, while O is the mast. The arrows, 1, 2 and 3, represent Galveston, Houston and Denver, respectively. It was impossible to raise Galveston, who can ordinarily be worked with the lowest of powers in daylight. With the loop presumably consuming about 60 watts of energy, I could just raise Houston, who was decidedly uncomplimentary about my signal strength and steadiness ("wts mtr om?"). Galveston is less than 75 miles distant and Houston is

(*Continued on page* 406)



The second loop arrangement is shown as 4A. A porcelain insulator is shown in place of the original ground condenser. Best results were obtained in last experiment by inserting a condenser in the position C-1 in Fig. 4B.

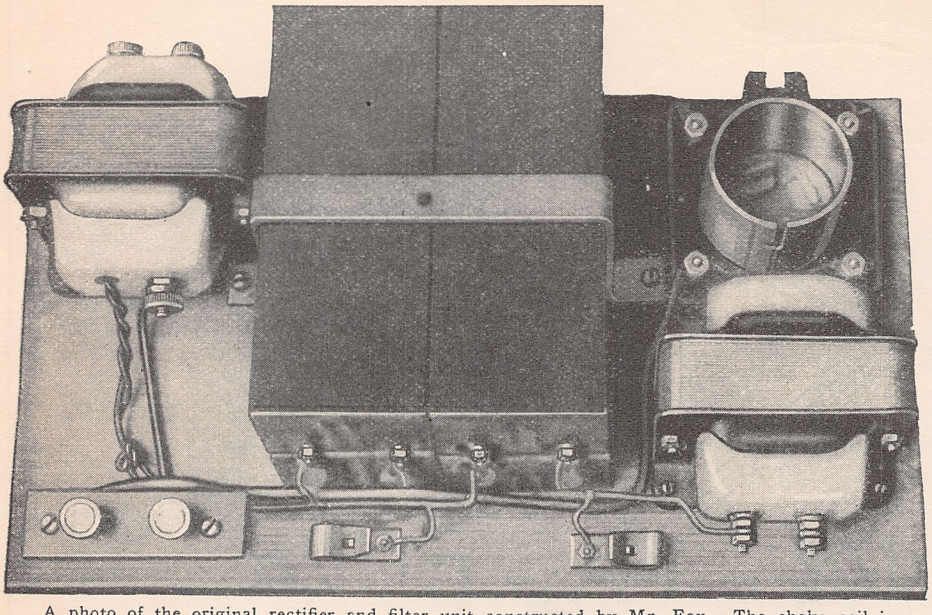


The original antenna employed, which was used as part of the loop.

A. C. Applied To Receiving Sets

By FLORIAN J. FOX, EX-ICEC

Contrary to the belief of some people, alternating current can be successfully employed for furnishing the plate and filament voltage for vacuum tubes in a receiving set. There are, however, limitations, but Mr. Fox has well covered the subject in this article.



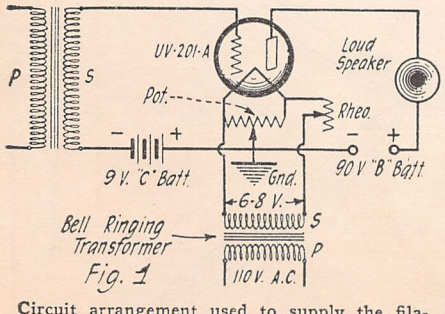
A photo of the original rectifier and filter unit constructed by Mr. Fox. The choke coil is situated on the left side of the board, the two fixed condensers in the center and the step-down transformer on the right with the rectifier tube socket directly behind it.

THE use of rectified A.C. for supplying plate potentials is by no means new. Amateurs, as well as broadcast stations, have used rectified A.C. to supply plate voltage for transmitting sets for some time. The application to receiving sets seems to have been delayed somewhat. This may be in part due to a lack of popular literature on the subject. This article has been prepared with the idea of filling such a need.

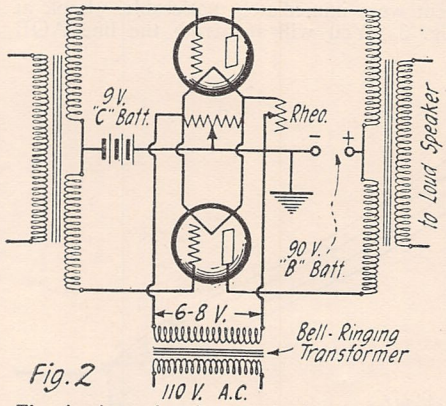
The following description should prove of special interest to users of dry cell tubes, who are wondering how to get more volume without distortion, due to overloading. Most users of dry cell tubes have learned by this time that their tubes will not handle the same output as the larger tubes will. With the use of A.C., the broadcast listener using dry cells can duplicate the performance of the larger tube sets. It has been found that small tubes can give sufficient output without overloading to fully load a larger tube. Before describing how to obtain rectified A.C. for the plate supply we shall point out briefly how to operate an amplifier filament on A.C. This is for the benefit of those who may not care to use the rectified A.C. at present, but who do want to use a larger tube.

Procure a good bell ringing transformer and a 200-ohm potentiometer. If a UV-201A tube is to be used, almost any bell ringing transformer rated from six to eight volts will carry the load nicely. A resistance with a mid-tap may, of course, be used in place of the potentiometer.

Since the voltage drop in the rheostat can not be used for furnishing a negative grid biasing potential, it will be necessary to use a "C" battery of about nine volts. This assumes that the plate voltage is between 90 and 130. The theory of grid biasing potentials has been described by other writers in recent issues of RADIO NEWS.



Circuit arrangement used to supply the filament current from the A.C. line source. A step-down transformer and a potentiometer make this possible.



The circuit employed to supply the current for the filaments of the vacuum tubes in a push-pull amplifier from the 110-v. A.C. line.

THE CIRCUIT

Fig. 1 shows how the circuit of an amplifier must be modified when lighting the tube with alternating current. The changes are extremely simple.

It might be added at this point that it is not advisable to operate a detector tube on alternating current. It will be too noisy. Keep the stepdown transformer as far away from the set as practicable, unless it happens to be one that is entirely enclosed in a heavy iron case. Leads going to the filament of the amplifier should be twisted to minimize electromagnetic induction. If some care is used, even two stages of audio frequency amplification may be operated satisfactorily in this manner.

Fig. 2 shows how "push-pull" amplifiers may be adapted to operate on alternating current.

We shall now show how A.C. may be used for furnishing plate voltage for the amplifiers.

The following equipment will be required:

1 Rectifier tube, UV-216 or WE-217A.
4 2-mfd. condensers.
1 Bell ringing transformer (8 V.).
1 Socket.
1 Choke coil (10-15 henries).

Suitable mounting material, wire, binding posts, etc.

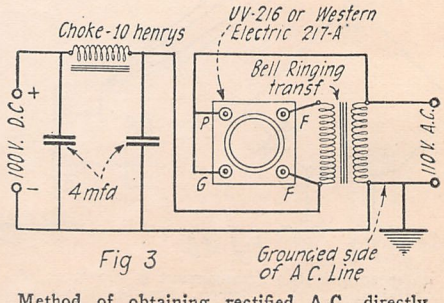
The rectifier tube should be either a UV-216, or a Western Electric 217-A. Almost any six-volt amplifying tube may be used for this purpose with fair results. Tubes having a relatively *low* plate-filament impedance are desired because the internal voltage drop will be less, thus leaving more voltage available for the amplifiers. When using amplifier tubes as rectifiers strap the grid and plate posts of the socket together.

Having decided upon the type of tube to use, choose a bell ringing transformer which will light the tube to somewhere near its proper brilliancy without overheating. The UV-216 tube will generally require the larger size transformer. Other tubes will operate on the smaller sizes. Care should be used in selecting this piece of apparatus because the voltage regulation is generally poor. A transformer which may deliver eight volts on open circuit may only deliver three or four volts under a one-ampere load.

CHEAP CONDENSERS AVAILABLE

The 2-mfd. condensers are of the paper type. Do not buy C.W. filter condensers rated at high voltages. Such condensers are quite expensive and are much better than those required for this purpose. There is no need of buying condensers rated to withstand more than 500 volts.

The choke coil is part of the low pass filter circuit. It was found that the primary winding of a bell-ringing transformer has close to 10 henries inductance and, therefore, serves the purpose very well indeed. One of the smaller types may be purchased for this purpose. The windings of a discarded amplifying transformer may also be used. In most cases the primary winding will have sufficient inductance. The secondary winding will generally have too much resistance, thus cutting down the available voltage materially.



Method of obtaining rectified A.C. directly from the line for amplifier plate voltage.

It will be noticed that the voltage is taken directly from the line, no step-up transformer being used. The writer does not wish to create the impression that such a transformer is not desirable. It was omitted for the sake of economy. The circuit shown delivers about 100 volts to one or two tubes and this is usually sufficient for most purposes.

If more than 90 to 100 volts are desired, a step-up transformer must be used. Either buy or make one that has a ratio of 1 to 2. If a small core is used, the primary should contain about 1,000 turns of No. 30 S.C.C. wire, while the secondary should be wound with No. 32 or 34 S.C.C. wire (2,000 turns). It is desirable to take out several taps on the secondary winding so voltages of from 100 to 175 may be obtained. Due to resistance losses, the voltage of the rectifier will be about 175 instead of 200 when using the step-up transformer described. Fig. 4 shows how a step-up transformer is connected or added to the rectifier circuit.

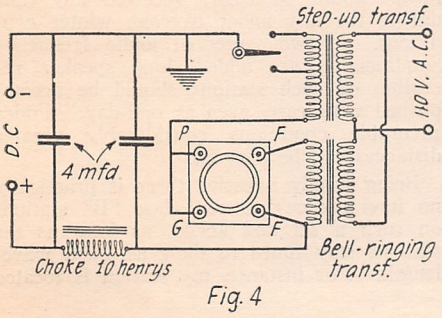


Fig. 4

Method of obtaining rectified A.C. when using a step-up transformer.

The details of mounting the rectifier will be left to the builder. The writer mounted his first model on a board 8 x 6 x 1 inches. Since then another arrangement has been used. The equipment was mounted on a 9 x 9-inch hard rubber panel fitted with a sub-base. The panel and base fit into a mahogany cabinet which matches the receiving set. The filament heating transformer, which lights the power stage of the receiving set, was also placed in this cabinet. All connections were brought to binding posts inside the cabinet through holes drilled in the back. The only things appearing on the panel are: A bezel, a lever switch for changing the plate voltage and a switch for opening the 110-volt A.C. supply.

A CAUTION

It is very important to note that when no step-up transformer is used, the grounded side of the A.C. supply leads must be found and connected exactly as shown in Fig. 3. The grounded side of the A.C. supply can be found by connecting one end of the filament of a 110-volt lamp to some other ground, such as your receiving set ground, and connecting the other end of the filament in turn to each of the two power leads. One lead will light the lamp and the other will not. The lead that does not light the lamp is grounded. This wire should be marked in some way. If a plug is used for connecting to the lighting circuit it should be a "polarity" plug, so that it can never be reversed if it is taken out and plugged in at some other time. "Polarity" plugs are those on which the contacts are placed at right angles to each other. The two parts will only fit one way. When a step-up transformer is used, these precautions are not necessary because the transformer insulates the 110-volt circuit from the rest of the set.

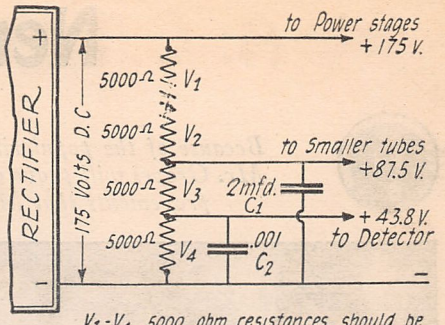


Fig. 5. Potentiometer for obtaining several values of plate voltage simultaneously. C1 and C2 are by-pass condensers.

The voltage produced by this rectifier is quite smooth and can be used on several stages of either radio or audio frequency or both. This presupposes that the tubes used will stand the voltage delivered by the rectifier. It is, of course, possible to obtain several plate voltages simultaneously by means of a potentiometer. Such a potentiometer may be made up of several resistances. (See Fig. 5.) However, for the sake of simplicity, the writer recommends the use of 45 volts of "B" battery for the detector and amplifier (dry cell tubes) and the use of the rectified A.C. for the plate of the power stage, or stages.

An Emergency Transformer

By EDWARD W. BERRY

IN an emergency, or for experimental purposes, a shunt or compound direct current motor of ⅛ or ¼ h.p. may often be used as a transformer to supply 5-watt tubes. The armature may be used as the primary, the shunt field for the high voltage supply—if the motor is compounded—and the series field for the filament supply.

The impedance of fractional horsepower, 110- or 200-volt armature is usually large enough that when placed across a 110-volt, 60-cycle supply it will not draw a very large input. In order to produce poles on the armature opposite the field poles on the frame, it will be necessary to rotate the brushes 90 electrical degrees. Most of these small motors are two-pole. This would mean 90 degrees on the commutator. In case the brushes are not movable it will be necessary to rotate the end cap. This can easily be done by removing the cover screws. If the cover is held by four screws it will be easy to reduce the A.C. hum by fastening the cover in this position.

All leads should be removed from the brush boxes and the supply, with auxiliary fuses, connected to them. An alternative method is to remove the brushes and solder the supply leads to the commutator segments 180 degrees apart. This permits regulation from practically zero voltage to maximum by rotating the armature. This will of course give simultaneous regulation to both the high and low voltages.

The shunt and the series field leads may be determined by testing with a lamp in series with the house mains. The series leads should give a good light and the shunt leads simply a spark on breaking contact. The shunt field should be placed in series, care being taken to see that they are not bucking, as in this case there will be little or no terminal voltage. The series field may either be placed in s ries or multiple, depending upon their individual voltages. If in series, they must not be bucking, and if in parallel they must buck or they will short circuit each other. An easy method to determine whether fields are bucking when parallel is to connect one set of leads together and touch the remaining two leads together. A good spark means wrong connection.

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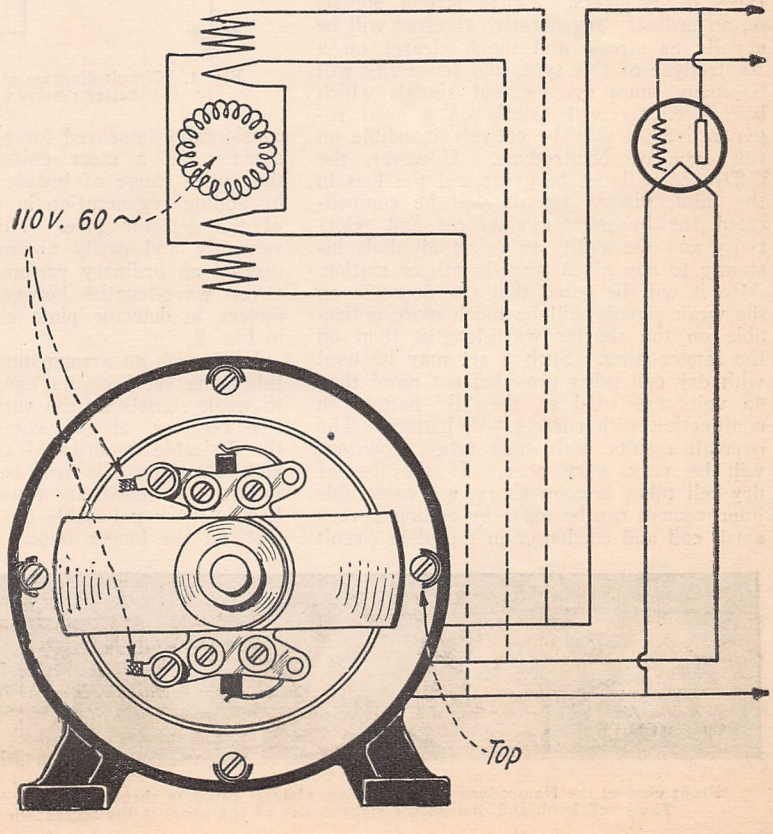
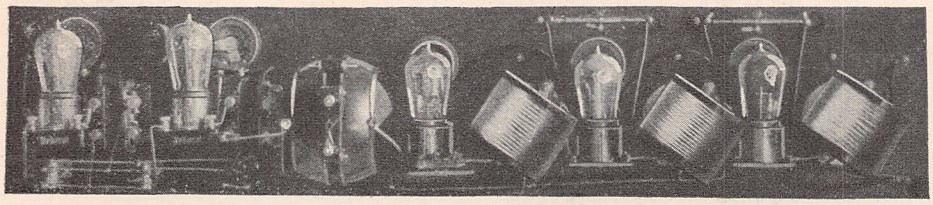


Details and diagram of connections of the arrangement of a shunt or compound direct current motor utilized as an emergency transformer for supplying the plate and filament voltage for transmitting vacuum tubes.

Neutrodyne Receivers

By A. L. GROVES

Because of the popularity of Neutrodyne receivers at the present time we believe this article by Mr. Groves will prove of considerable interest to our readers. There are a number of little improvements that Mr. Groves has worked out that will no doubt be of benefit to many.



Rear view of a five tube Neutrodyne receiver showing the arrangement of the instruments. This consists of two stages of tuned radio frequency amplification, a detector and two stages of audio frequency amplification.

TAKING all things into consideration, the Neutrodyne method of reception is one of the most satisfactory systems for reproducing broadcast programs. It is second only to the Super-Heterodyne which employs many more tubes than the Neutrodyne.

Just what form the receiver should take depends upon the desire of the individual, but whichever of the forms given here is selected, there will be little cause for regret.

In its most condensed form the Neutrodyne circuit consists of two stages of tuned radio frequency amplification with the tube capacity neutralized to prevent regeneration. To this may be added audio frequency amplification in the usual manner.

For best results in such a circuit the two radio frequency tubes should be type UV-201A or C-301A and the detector type UV-200 or C-300. The audio frequency amplifier tubes should also be UV-201As or C-301As. All of these tubes require a six-volt "A" battery, and from 45 to 90 volts may be used on the plates of the amplifier tubes as the "B" battery. This should be tapped at from 18 to 22½ volts for the detector.

Such a set will reproduce speech and music much more clearly than the usual types of receivers. Fairly strong signals on an ordinary regenerative receiver will be equally as strong and much clearer on a Neutrodyne of this type, and selectivity will be many times greater, but signals which have been received faintly on a *good* regenerative set may be entirely inaudible on this type of Neutrodyne. However, the difference will not be great and the loss in the faint, distant signals will be compensated for by greater clearness and selectivity and the ability to re-set all dials instantly to any given wave-length or station. Also it will be noted that the decrease on the weak signals will be much more noticeable on the shorter wave-lengths than on the longer ones. Such a set may be used with dry cell tubes provided not more than 45 volts are used as the "B" battery in conjunction with correct "A" battery. The over-all results with such tubes, however, will be very, very poor. If the use of dry cell tubes is compulsory, a considerable improvement can be made by adding a very small coil and condenser in the plate circuit of the radio frequency tubes as shown at X in Fig. 1. The coil may be composed of 10 turns of wire on a 3-inch cylinder and the variable condenser given just enough capacity to allow the set to be completely neutralized by the neutrodons in the regular manner. The coil is then left strictly alone and the operation of the set performed in the usual manner. The arrangement will not, however, compare with the use of the recommended tubes.

REGENERATION ADDED

The standard Neutrodyne circuit can be considerably improved for reception of weak signals and a more uniform action over the entire range of broadcast wave-lengths by adding regeneration in the plate circuit of the detector tube. This may be conveniently and easily accomplished by connecting an ordinary variometer designed to cover wave-lengths between 200 and 600 meters in detector plate circuit, as shown in Fig. 2.

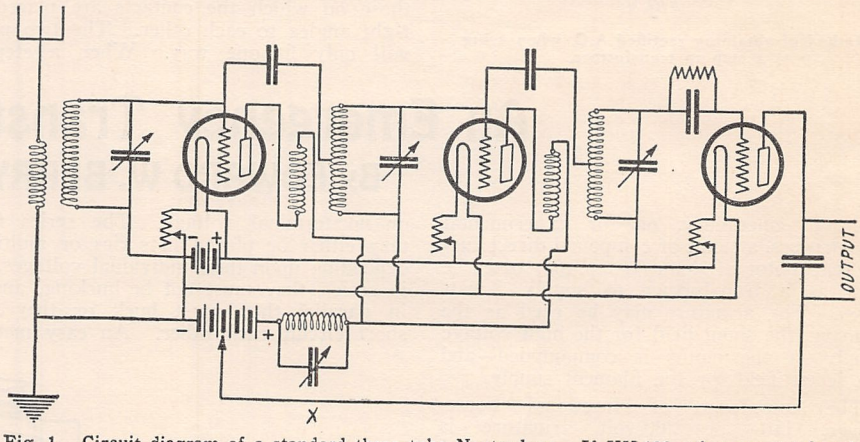
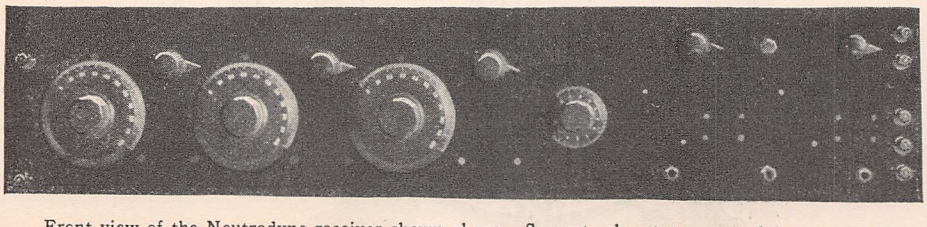


Fig. 1. Circuit diagram of a standard three tube Neutrodyne. If UV-199 tubes are employed better results will be had by using the coil and condenser shown at X.

With such an arrangement, using six-volt tubes the set becomes equally as sensitive to weak signals as the very best regenerative receiver, at the same time retaining the desirable qualities of clearness, volume and selectivity. It will be noted that the increase in sensitivity caused by regeneration is more noticeable on the short waves than on the longer ones.



Front view of the Neutrodyne receiver shown above. Separate rheostats are used for each tube. The small knob and dial on the right center of the panel is the regeneration control.

While such a set will operate very well on small aerials, or even on a loop, it is not at all recommended for this class of work. The aerial, acting almost entirely as a collector and not being tuned direct, should be made as long as conveniently possible, up to 350 or 375 feet total length of single wire. It should run as directly away from the instrument as possible and preferably from 40 to 60 feet high, especially at the end away from the instrument.

With such a set and aerial as described, all Class B stations within 200 and 250 miles should be easily received any time during the *day* under average winter conditions. If two stages of audio frequency amplification are added, loud speaker reception of such stations should be accomplished with ease, even at mid-day. Under favorable conditions considerably greater distances can be covered.

Being highly selective there is practically no interference between class "B" stations on such a set and aerial, as long as the stations stay tuned to their assigned wave-length. For instance, my station is located less than 40 miles from WCAP and WRC, which stations use a wave-length of 469 meters. On the next higher wave there are two Texas stations, WBAP and WFAA, both of which are more than 1,200 miles from me, yet the Washington stations can easily and completely be eliminated while receiving either of the Texas stations. Likewise WLW and WSAI operate on 309 meters, while Oakland, Calif., KGO, operates on 312 meters. The difference in scale reading between these two waves is only about three-quarters of a degree, yet either of the Cincinnati stations can be completely tuned out and KGO received with ease.

Photographs herewith show views of the regenerative Neutrodyne with two stages of audio frequency amplification. The panel is 7 inches high and 34 inches long. The instruments are so placed that all leads are extremely short and direct as possible. No fancy wiring is tolerated. After the set is constructed as carefully as possible, the neutralizing condensers are adjusted in the regular manner and trials made to determine if beat notes or regenerative clicks can be heard under any condition over the entire range of wave-length while the variometer is at its minimum inductance value. The job should not be considered complete until all oscillations have been eliminated.

EXACT READINGS

It will be noted by this time that all dials do not read exactly the same for any given wave-length. This is due to several causes, chief among which is the almost impossible task of making condensers and inductances of exactly the same values and the fact that the first dial is somewhat influenced by the aerial and ground system and the third dial is usually still more influenced by the different characteristics of the detector tube and detector circuit from those of the two radio frequency tubes and circuits.

However, if standard neutroformers are used, the dial readings should not vary more than four or five degrees at most.

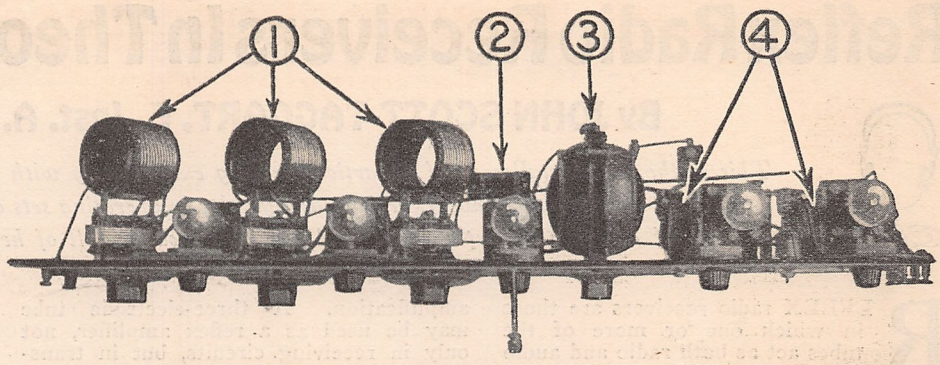
Select some station operating on or slightly above 400 meters—WHB on 411 meters is usually selected for this purpose—make careful note of the position of each dial and then figure the average reading of each. Loosen slightly the dials on the condenser shafts and, holding the rotary plates stationary while the dial revolves, set all dials to the average. Then listen for the station again and see that it tunes in with a maximum intensity with all dials at exactly the same figure. If this operation has been performed correctly all other stations in class B and C range of wave-lengths should tune in with the dials reading with not more than one degree of difference. If such is not the case another further average is necessary. The work consumed in this process will be amply repaid in simplified tuning.

As the different stations are heard, a log should be made of the dial settings of each, so that they may be tuned in again at any future time. The variometer dial is, of course, only used when signals are not strong enough without regeneration, so this adjustment may not be taken into consideration most of the time.

Should a station not be brought in at exactly the same setting at different times do not blame the set. It is only necessary to remember that all transmitters do not stay absolutely on their assigned wave. Note the standard wave stations as given by the Bureau of Standards and calibrate the set by them as far as possible.

If experiments with commercial models have proven unsatisfactory, it is suggested the accompanying diagrams be studied and the set rewired according to one of them, taking particular care that a rheostat is used for each tube, connected as shown.

Under no circumstances try to force loud signals by using too much "B" battery; 67½ volts will prove sufficient and under no circumstances should more than 90 volts be used. It will be found well worth while to place the component instruments on the panel strung out in order approximately as indicated in the wiring diagram rather than attempting to save space by the use of a short panel and a sub-base.



Top view of the Neutrodyne set showing the position of the apparatus. No. 1 shows the Neutroformers; 2 is the grid condenser; 3 is the detector plate variometer; and 4 shows the A.F. transformers.

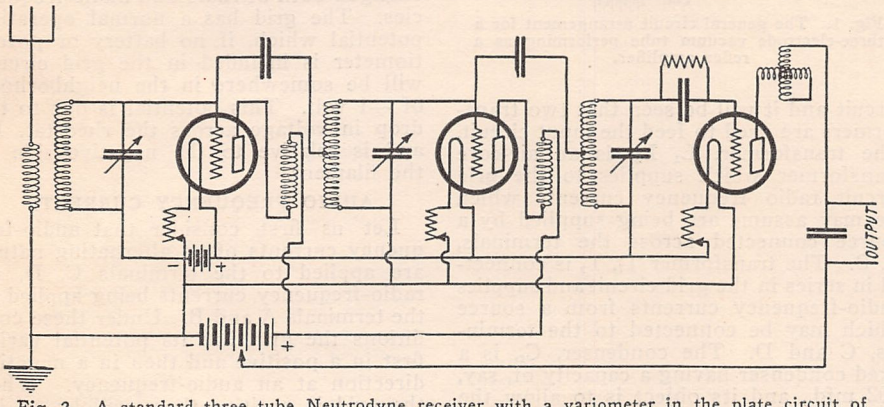


Fig. 2. A standard three tube Neutrodyne receiver with a variometer in the plate circuit of the detector for regeneration.

SEPARATE UNITS

In building a non-regenerative Neutrodyne plus two stages of audio frequency amplification, the panel should be at least 7 by 30 inches and if regeneration is added, as in Fig. 2, an additional 4 inches must be added to the length of the panel. It pays well to arrange the instruments after this fashion, but if it is not desired to have one panel this length, it is recommended that the main tuning unit and the audio frequency amplifiers be built separately. If this plan is followed, a standard 7 by 21 inch panel should be used for a non-regenerative Neutrodyne and a standard 7 by 24-inch panel for the regenerative instrument. The audio frequency amplifier unit including the filament control jacks, etc., should then be made on a panel not less than 7 by 10 inches.

If it is impossible for the owner of a Neutrodyne to get up a fairly long aerial, much better signal strength and distance will be obtained from a short aerial by replacing the first neutroformer with a fixed coil. Thus only two neutroformers are used, the first having its place taken by the coil and condenser unit which is connected to the grid of the first tube in the well known single circuit manner. All aerials having a total length of less than 150 feet should, by all means, use this system if greatest volume and distance is desired. For all ordinary purposes, the coil should be made by winding 75 turns of No. 24 D.C.C. wire on a 3-inch bakelite tube. The condenser should be of approximately .0005 mfd. capacity.

Care must be exercised in placing this coil and condenser so the minimum coupling between this unit and the adjacent neutroformer results.

Should one wish to make a Neutrodyne especially for UV-199 or C-299 tubes, desiring results rather than great simplicity in tuning, the three-stage method will prove exceptionally good. The set is constructed as the one shown in Fig. 1 except the addition of one neutro-

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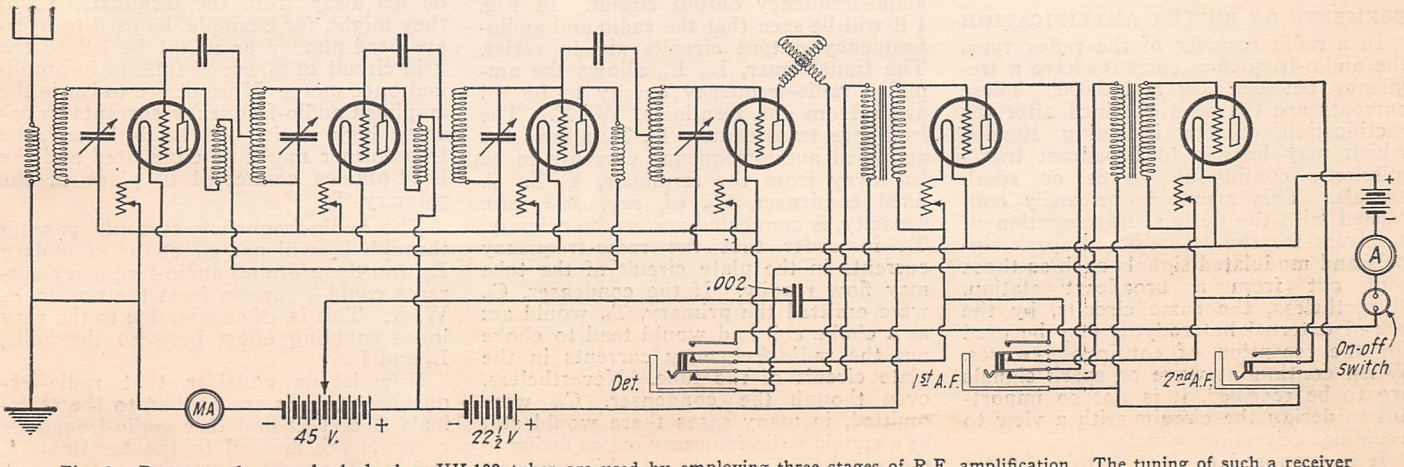


Fig. 3. Better results may be had when UV-199 tubes are used by employing three stages of R.F. amplification. The tuning of such a receiver will be extremely difficult. Here is the circuit. Filament control jacks are employed on the detector and audio frequency amplifier tubes.

Reflex Radio Receivers In Theory and Practice

By JOHN SCOTT-TAGGART, F. Inst. A. M. I. R. E.

This is the first installment of an article dealing exhaustively with reflex amplification in all its forms. Those who have experienced difficulty in operating sets of this type or are desirous of carrying on experiments will find this treatise full of helpful information.

REFLEX radio receivers are those in which one or more of the tubes act as both radio and audio frequency amplifiers. It is assumed, of course, that the reader is well acquainted with the ordinary principles of radio frequency amplification and the amplification of the audio frequency currents obtained after the process of rectification which will usually be carried out by means of a crystal detector or three-electrode tube acting in such a capacity.

It was found as long ago as 1912 that the three-electrode tube was not only capable of amplifying radio-frequency oscillations and audio-frequency currents, but that by using proper circuits the tube could amplify both types of currents at the same time without there being any undesirable mutual interference. Circuits in which a tube acts both as radio-frequency amplifier and as audio-frequency amplifier are known as reflex circuits. This latter term implies that after rectification the audio-frequency currents are led back and amplified by one of the tubes which has acted as an amplifier of the original radio-frequency currents.

HIGH SENSITIVITY

Reflex receivers are naturally highly sensitive because one tube is giving two stages of amplification. This type of circuit naturally results in a very appreciable economy in vacuum tubes, and in many cases only half the number of tubes are necessary to carry out any desired reception.

Very little has been accomplished in the way of developing reflex amplification circuits except during the past year. This fact is significant because there are numerous special problems which have to be faced and solved when a radio receiver is being designed to operate on the reflex amplification principle. The greatest problem is to prevent audio-frequency regeneration which causes buzzing or squealing noises to be heard in the receiver. The way in which the various difficulties may be met are described in the following pages, and it will be seen that reflex amplification is a subject in itself.

ELEMENTS OF REFLEX AMPLIFICATION

In a radio receiver of the reflex type, the audio-frequency currents have a frequency between 200 and 3,000. These currents are the ones obtained after the rectification of the incoming signals, which may be due to broadcast transmissions, continuous waves or spark signals. This article is primarily concerned with the design and operation of receivers for the reception of spark signals and modulated signals such as those sent out from a broadcast station. Nevertheless, the same circuits, by the use of external heterodyne, may be used for the reception of continuous waves. When continuous wave or spark signals are to be received, it is not so important to design the circuits with a view to avoiding distortion effects.

It is proposed to deal in this chapter with the general principles of reflex amplification. A three-electrode tube may be used as a reflex amplifier, not only in receiving circuits, but in transmitting arrangements.

GENERAL ARRANGEMENTS

Fig. 1 shows the general arrangement of a three-electrode tube as a reflex amplifier. The input circuit is the grid

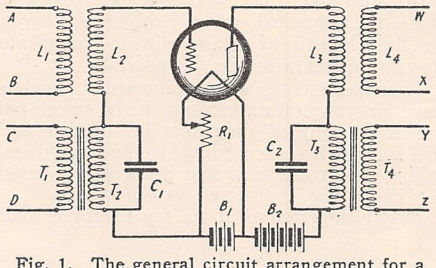


Fig. 1. The general circuit arrangement for a three-electrode vacuum tube performing as a reflex amplifier.

circuit and it will be seen that two transformers are used to feed the input circuit. The transformer, L_1 L_2, is an air-core transformer which supplies to the grid circuit radio frequency currents which we may assume are being supplied by a source connected across the terminals, A, B. The transformer T_1, T_2 is connected in series in the grid circuit and supplies audio-frequency currents from a source which may be connected to the terminals, C and D. The condenser, C_1, is a fixed condenser having a capacity of, say, .002 mfd., and its object is to allow the radio-frequency current induced into L_2 to communicate its effect to the filament, F_1, of the tube. If the condenser C_1, is omitted, the secondary, T_2, will act as a choke to the radio-frequency currents in the grid circuit, and this will prevent the full voltage supplied by L_2 to be communicated to the grid of the tube. In most transformers, however, there is a fairly substantial distributed capacity in the secondary windings and this will, in many cases, be sufficient to allow the passage of radio-frequency currents.

TWO OUTPUT CIRCUITS

There are two output circuits, one a radio-frequency output and the other an audio-frequency output circuit. In Fig. 1 it will be seen that the radio and audio-frequency output circuits are in series. The transformer, L_3, L_4, allows the amplified radio-frequency energy to be led away from the terminals, W, X. The iron-core transformer, T_3, T_4, allows the amplified audio-frequency currents to be led away from the terminals, Y, Z. A fixed condenser, C_2, of, say, .002 mfd. capacity, is connected across the primary, T_3, in order that the radio-frequency currents in the plate circuit of the tube may flow readily. If the condenser, C_2, were omitted the primary, T_3, would act as a choke coil and would tend to choke out the radio-frequency currents in the plate circuit of the tube. Nevertheless, even though the condenser, C_2, were omitted, in many cases there would still be a certain radio-frequency output owing to the distributed capacity of the windings. T_3. This distributed capacity has a very important bearing on the operation of reflex amplification circuits, and it is almost impossible to lay down any definite rule about the necessity for by-pass condensers such as C_1 and C_2. In some circuits, or when using certain component parts, these by-pass condensers are essential; in other cases they may be omitted; in some cases the value of these condensers is a matter for experiment with the particular components used. Different transformers, for example, have different distributed capacities and different impedances; this also applies to head-phones and loud speakers. These facts, however, are merely being stated for introductory purposes.

Looking at the Fig. 1 circuit we see that the grid of the tube has its potential changed both at radio and audio-frequencies. The grid has a normal operating potential which, if no battery or potentiometer is included in the grid circuit, will be somewhere in the neighborhood of —1 volt. This potential is due to the drop in voltage across the rheostat, R_1, and is relative to the negative side of the filament.

AUDIO FREQUENCY CURRENTS

Let us first consider that audio-frequency currents of an alternating nature are applied to the terminals C, D, no radio-frequency currents being applied to the terminals A and B. Under these conditions the grid has its potential varied first in a positive and then in a negative direction at an audio-frequency. When the grid is positive there will be an increase in the plate current and this will flow through the primary, L_3, of the radio-frequency transformer, L_3, L_4, and through the primary, T_3, of the iron-core audio-frequency transformer, T_3, T_4, and then through the "B" battery to the filament. The currents flowing through the primary, T_3, will be amplified currents and the condenser, C_2, will have practically no effect on their amplitude as this condenser is of small value in relation to the frequency of the currents. The audio-frequency currents flowing through T_3 will be passed on to T_4, the transformer being of the iron-core type. The amplified audio-frequency currents may be led away from the terminals, Y, Z; they might, for example, be used to operate head-phones or might be led to the grid circuit of a second tube to be amplified once more. If we desire to cause the amplified audio-frequency currents to operate high resistance head-phones, the transformer might be eliminated and the head-phones connected in place of the primary, T_3.

The audio-frequency currents passing through L_3 will not effect the secondary L_4, and therefore no audio-frequency currents could be drawn from the terminals, W, X. This is, of course, due to the very loose coupling effect between the coils, L_3 and L_4.

Now let us consider that radio-frequency currents are applied to the terminals A and D and that audio-frequency currents are applied to the terminals C and D. The radio-frequency currents will be passed on by means of a transformer.

L_1, L_2, to the grid circuit of the tube and the condenser, C_1, will obviate any choking effect which the secondary, T_2, might have on the radio-frequency currents. These latter, therefore, might be said to ignore the transformer in the grid circuit. The grid, G_1, will now have its potential varied above and below its normal operating potential which will be —1 volt. Amplified radio-frequency oscillations will flow in the plate circuit of the tube and these will pass through L_3, the condenser, C_2, and the "B" battery. Here again the radio-frequency currents ignore the transformer, T_3, T_4, and pass through the condenser, C_2. If this condenser were missing they would flow through the natural condenser which constitutes the distributed capacity of the primary, T_3. The radio-frequency currents flowing through L_3 are passed on to the secondary, L_4, and may be drawn away from the terminals, W, X. They might be detected, for example, by connecting a crystal detector and head-phones across the terminals, W, X. For the sake of simplicity, the radio-frequency transformers are shown aperiodic, but there is no reason why they should not be tuned to the frequency of the radio-frequency currents being amplified by the tube.

We see then that the tube will act as a radio and audio-frequency amplifier because the frequencies are so different that the transformers by their very nature act as "sifters-out" of the currents they wish to select. Let us now consider that the radio and audio-frequency currents are both being applied to the input circuit of the tube. The grid potentials are now somewhat complex. We can consider the audio-frequency currents as taking control and slowly moving the operating point on the grid potential plate current characteristic curve of the tube; in other words, the normal operating potential of the grid, instead of remaining at —1 volt, is being varied slowly on either side of this by the audio-frequency currents.

OPERATING POTENTIALS

At one instant the operating potential of the grid may be —1 volt, the next —½ volt, then back again to —1 volt, and then —1½ volts, and so on. These changes are taking place at, say, 1,000

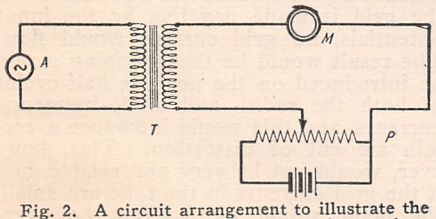


Fig. 2. A circuit arrangement to illustrate the effect of the super-imposition of an alternating current on a direct current on a vacuum tube.

times per second, which is a very slow frequency when compared to the radio-frequency currents which we will assume are due to signals having a wave-length of 300 meters, the currents, therefore, having a frequency of one million. We can relatively say that the grid potential is being only slowly varied by the audio-frequency currents. We have assumed that the change of voltage from —1 volt to —½ volt takes 1/4,000 part of a second. During this period the grid is having impressed on it a fluctuating voltage which is first positive and then negative, and the frequency of which is one million per second. During the time taken for the grid potential to become ½ a volt less negative due to the audio-frequency currents, there will be 250 complete cycles of oscillating current applied to the grid. From the point of view of the radio-frequency currents applied to the grid, the potential of the latter remains practically steady, and, in fact, this slow audio-frequency change of the normal grid potential does not interfere with the radio-frequency amplifying action of the tube.

TWO CURRENTS

In the plate circuit of the tube we have the two sets of currents flowing. We have the audio-frequency changes of the steady plate current and super-imposed on these we have the radio-frequency current changes which are 1,000 times as rapid.

It is most important that a proper conception should be had of the fluctuating plate current, and one or two analogies may help to make it clear, first, how the tube will act as an amplifier of two different sets of currents and, second, how these currents can be amplified without mutually interfering with each other.

A USEFUL ANALOGY

A very useful analogy is that shown in Fig. 2. In this figure we have a potentiometer, P, passing a steady current through the direct current ammeter, M; at the same time an alternating current is being fed into the ammeter circuit by means of the transformer, T, the letter A representing the alternator. The needle of the ammeter will normally take a definite position. If the flood on the potentiometer is left stationary, it will be noticed that although the ammeter needle remains, on an average, in one position, the audio-frequency currents superimposed on the direct currents in the ammeter circuit will cause the needle to vibrate on either side of its normal value. By moving the potentiometer slider more to the left, a larger direct current will be made to pass through the ammeter M; but although the needle of the ammeter will move to one side, yet it will still continue to vibrate in sympathy with the alternating current which first adds and then subtracts itself from the steady current flowing through the ammeter. Thus, although the steady current flowing through the ammeter may be varied by moving the slider up and down along the potentiometer resistance, yet the audio-frequency vibrations due to the alternating current will still remain. The ammeter M may therefore be said to be responsive, not only to the slow changes in the current flowing through it, but also, simultaneously be responsive to the more rapid alternating current. It must not, therefore, be thought something very unusual for a tube to be carrying out two duties at once.

A FURTHER ANALOGY

Another analogy which may help is that of a person swinging backwards and forwards in an ordinary child's swing. If one could watch this simple act from a stationary spot in the universe, the motion of the person on the swing would be very complex. Not only would he be moving backwards and forwards in the swing, but he would be traveling through space at a terrific rate. To those of us on earth, the person in the swing is simply carrying out a very elementary motion, and only a single motion; we are not concerned with the other attendant motion of the earth.

Consider again a person walking up and down the corridor of a train in motion. If the train is going smoothly and the blinds are all drawn, those in the train would only be concerned with the up and down motion of the man in the corridor; he would not be concerned with the forward motion of the train, and this would in no wise affect his walking up and down. Conversely, the train, if it had a mind, would not be at all concerned as to what was going on inside the corridor; its sole object is to travel from one spot to another, and the mere walking up and down of a person along the corridor would not in any way affect this motion.

Similarly, the radio-frequency currents and audio-frequency currents both use the tube as an amplifier, but ignore each other in the process of amplification. Only when one set of currents seriously alter the operating conditions does the other set of currents affect it. As long

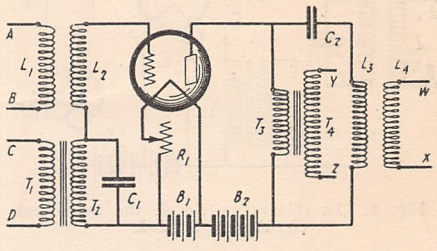


Fig. 3. A reflex circuit arranged so as to have a parallel output connection.

as the man in the corridor only walks up and down, the train does not mind, but if he at one end puts on the brake, then the train immediately feels the effect and its motion is affected. Innumerable examples could be given of two separate motions taking place independently of each other, but the examples given should be sufficient to indicate that widely different frequencies may be amplified by a tube without any trouble whatever. There are, however, conditions in which one set of currents will interfere with the other, and examples of this will be given as we proceed.

PARALLEL OUTPUT CONNECTIONS

Although in Fig. 1 we have indicated how the radio and audio-frequency output currents may be drawn off separately by the use of different types of transformers, yet there is another general method of arranging these transformers. In Fig. 1 they are shown connected in series, while in Fig. 3 a change has been made by connecting them in parallel. It will be seen in Fig. 3 that while the input circuits remain the same as in Fig. 1, the radio-frequency transformer, L_3, L_4, is no longer in series with the primary, T_3, of the iron-core transformer T_3 T_4, used for drawing off the audio-frequency currents. The primary, T_3, of the iron-core transformer is now in the plate circuit of the tube and the normal steady plate current flows through this transformer. The radio-frequency currents will not pass through the primary, T_3, on account of the impedance of the winding, T_3, and the currents therefore prefer to pass round the path comprising the condenser, C_2, and the inductance, L_3. The condenser, C_2, may have a capacity of .002 mfd. The primary, T_3, will not act as a short circuit to the high-frequency currents because it would choke them back. Also the condenser, C_2, in series with L_3, would not short circuit the audio-frequency currents passing through T_3 because the condenser, C_2, has a relatively small capacity, and the audio-frequency currents which might pass through C_2, would be exceedingly feeble. In any case, these audio-frequency currents would not be passed on to the secondary, L_4, of the transformer, L_3 L_4.

We thus see that it is possible by using parallel connections of this kind to still separate the radio and the audio-frequency currents in the plate circuit of the tube. Instead of a transformer, T_3 T_4, head phones might, of course, be connected in the place of T_3, if the audio-

frequency currents are to be indicated without any further amplification.

The remarks which have already been made in regard to the distributed capacity of transformer windings will explain why an air-core choke coil is generally inserted in series with the head-phones or primary of an audio frequency trans-

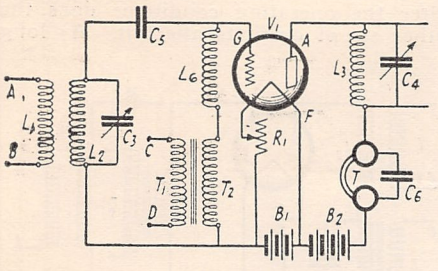


Fig. 5. In this reflex circuit the two input circuits are divided.

former through which the audio-frequency currents pass.

Fig 4. shows an amplifier circuit similar to Fig. 3 in general principles. It will be noted, however, that head-phones have been included in the plate circuit of the tube and that an air-core choke coil L_5, consisting of, say, 200 turns of wire wound on a 3 in. tube, is connected in the plate circuit of the tube. The audio-frequency currents applied to the grid of the tube are amplified in the usual way, and the amplified currents will pass through L_5 unaffected and through the telephones T. The radio-frequency currents, however, are very effectively choked back by the choke coil L_5, and they therefore go along the easier path which comprises the condenser C_2 and the inductance L_3, which is shown tuned by the condenser C_4. The disadvantage of the parallel arrangement in Fig. 3 is that the primary T_2 in actual practice has a substantial distributed capacity which acts as a short circuit for the radio-frequency currents. The result is that the currents which pass through C_2 and L_3 are not as calm as they would otherwise be. If, however, the choke coil is connected as shown in Fig. 4, practically the whole of the radio-frequency currents will pass round the by-pass circuit and will energize the circuit L_3 C_4, which is tuned to the frequency of the oscillations. It will be noticed that the bottom of the circuit L_3 C_4 is connected to the negative terminal of the filament battery B_1. The actual connection might be made to the positive terminal of B_1 or to the positive terminal of the battery B_2 without making very much difference. The important point to bear in mind is that the audio-frequency output circuit is to be separated from the radio-frequency output circuit by means of a choke coil, or the choking effect of a transformer winding or head-phones.

In Fig. 4 we have shown the two output circuits divided. The same idea may be applied to the input circuits; Fig. 5

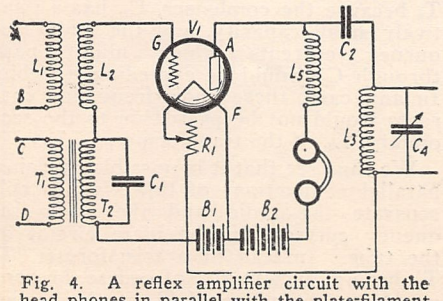


Fig. 4. A reflex amplifier circuit with the head phones in parallel with the plate-filament circuit.

illustrates this. The radio-frequency oscillations are applied by means of a transformer L_1 L_2 to the grid circuit of the tube, a condenser C_5 of, say, .0003 mfd. being connected in the position shown. The secondary T_2 of the iron-core transformer T_1 T_2 is connected across the grid and filament of the tube, a choke coil L_6, consisting of an air-core inductance, being connected in the position shown. This choke coil might be omitted, but owing to the self-capacity of the winding T_2 the high impedance of the latter winding will be rendered more or less ineffective and a partial short circuit of the radio-frequency currents will occur. It is therefore desirable to connect a choke coil L_6 of small distributed capacity in series with T_2. This choke coil will, therefore, prevent the radio-frequency potentials, which are communicated by the circuit L_2 C_3 to the grid G_1, from being short circuited through the audio-frequency supply circuit. The audio-frequency currents to be amplified are applied to the terminals C D and are communicated to the grid through the transformer T_1 T_2. The coil L_6, of course, does not in any way affect the audio-frequency potentials being applied to the grid G_1.

In this circuit the input circuits are in parallel; the condenser C_5 is inserted in the position shown for the simple reason that if it were not there the audio-frequency currents supplied by T_2 would be short circuited through the inductance L_2

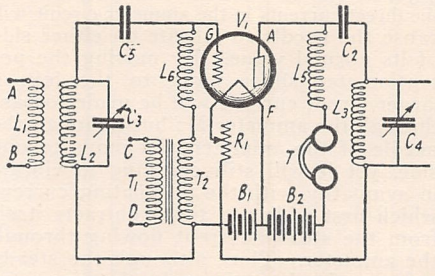


Fig. 6. A reflex circuit with both input and output circuits in parallel.

just as effectively as if the latter were simply a wire connection. The blocking condenser C_5 is therefore inserted to prevent such a short circuit. If C_5 has a value of .002 mfd. or upwards, it will begin to act as partial short circuit of the frequency currents in the plate circuit of the tube. A detector of some kind might be connected across L_3 C_4.

Fig. 6 is a circuit in which both the input circuits are in parallel, and also the output circuits. The left-hand side of the circuit in Fig. 6 is similar to the input circuit of the circuit just described, while the output circuits are of such a character that the audio-frequency currents pass through one branch, while the radio-frequency currents pass through the other branch of the output circuit. To prevent the radio-frequency currents from passing around the telephones, or audio-frequency circuit, the choke coil L_5 is connected in the position shown. The fixed condenser C_2 prevents the inductance L_3 from short circuiting the telephone circuit, and its value may be anything from about .0003 mfd. to .002 mfd. Even at this latter value, a slight reduction in the telephone signal strength is usually appreciable, and therefore larger values for C_2 are not recommended. This condenser may be called the "coupling condenser," because it couples the oscillatory circuit L_3C_4, which now replaces the original transformer winding, to the plate circuit of the tube. The steady plate current now passes through the telephone circuit and does not pass through L_3. The radio-frequency currents, instead of passing through L_5 and T, go round the said path, C_2 L_3 C_4, and back to the filament, energizing the circuit L_3 C_4 on the way.

The bottom end of L_3 C_4 is connected in Fig. 6 to the negative terminal of the filament battery B_1, but the connection might be made, with similar results, to the positive terminal of B_1, or to the positive terminal of B_2. Results would also be obtainable if the connection were made to the top side of the telephones T, but in the latter case the radio-frequency currents would pass through the telephone circuit (the telephones would have, of course, to be shunted by a fixed condenser), and this would be exactly what we are trying to avoid.

The reasons for employing parallel connections will be better understood when we come to some practical circuits. Suffice it to say that, unlike many alternative arrangements, there are distinct reasons for using the parallel arrangement instead of the series method of connecting input and output circuits.

REFLEX AMPLIFICATION AND THE CHARACTERISTICS OF THE TUBE

Generally speaking, a substantial emission is required from the filament of a tube to act as a reflex amplifier. The reason is simple; the grid potential variations correspond to the sum of the amplitudes of the radio- and audio-frequency currents. A long characteristic curve is therefore most desirable. A tube with small filament emission is not to be recommended.

A grid potential plate current characteristic curve is illustrated in Fig. 7. The normal operating point may be at either A. B, C or D; the point A is most undesirable because there is a steady grid current flowing which will introduce heavy damping in both the audio-frequency input circuit and the radio-frequency input circuit. This, moreover, will introduce a certain amount of distortion as well as the weakening of the input potentials. The points B and C are the best, provided the input currents are not of too large a magnitude. The point D is also, to a certain extent, undesirable, because when the grid became positive a grid current will flow, but when the grid is made negative by the input potentials, no grid current would flow. The result would be that damping would be introduced on the positive half-cycles of both the radio- and audio-frequency currents, and this would introduce a certain amount of distortion. This, however, would not be very appreciable, and if the grid currents in the tube are small, the point would most likely be overlooked.

A more important consideration is a straightness of the characteristic curve along the portion to be utilized. The curve between D and A should be as straight as possible in order to obtain faithful amplification without distortion. If the representative point on the characteristic curve travels round a bend

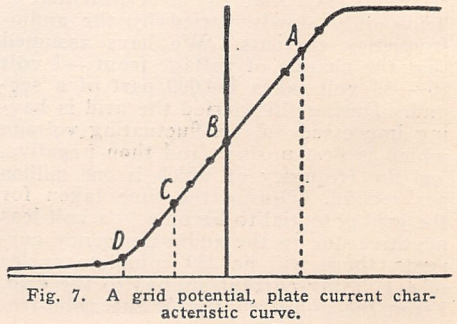


Fig. 7. A grid potential, plate current characteristic curve.

serious distortion will occur, due to the rectification effect.

Above and below each of the points A, B, C and D, we have shown dots on the characteristic curve, these indicating the maximum positive and negative changes in the plate current, due to the audio-frequency cycle. When the grid potential is such that the plate current is at the higher dot above B, for example, we have to consider that at this moment a positive half-cycle may be applied to the grid by the radio-frequency input circuit. If the radio-frequency currents are very feeble in relation to the audio-frequency currents, we can ignore them from the point of view of studying the characteristic curve. If, on the other hand, the radio-frequency currents are of a strength comparable to the audio-frequency currents, we have to consider the amplitude of the positive half-cycle added to the amplitude of the positive half-cycle of the audio-frequency currents. The same, of course, applies to the negative half-cycles of the two sets of currents. We have to select such a point on the characteristic curve, that if we add the two positive amplitudes together and the two negative amplitudes together, the representative point on the characteristic will not move off a straight portion. This is one of the first important rules in connection with reflex amplification.

THE CHARACTERISTIC CURVE TO BE SELECTED

Stated briefly, the rule is that the characteristic curve should be selected, and the point on the characteristic curve selected so that the representative point always keeps on a straight portion of the characteristic curve. If this is done, the fullest amplification will be accorded to both the radio- and the audio-frequency currents. If we operate the tube at some such point as A, or even sometimes C, we are in danger, if the radio-frequency currents are of large amplitude, of overrunning the tube in the sense that the representative point will, in the case of the positive or negative half-cycles, travel round a bend in the curve, the result being insufficient amplification, and a considerable amount of distortion.

In reflex amplification circuits, as in any other amplification circuit, it is desirable to have the characteristic curve to the left of the point representing zero grid volts. Under these conditions grid currents will be non-existent, and distortion from this cause will not arise.

Fig. 8 shows a characteristic curve which has been moved to the left-hand side of the line XY. This movement of the characteristic curve is effected by using a higher plate voltage. Instead of operating the grid potential at zero volts, which would bring us to saturation point on the characteristic curve, a negative potential, sufficient to bring the normal operating point to about the middle of the characteristic curve, is applied to the grid. In the Fig. 8, since the steepness at the points A, B and C is the same, the only

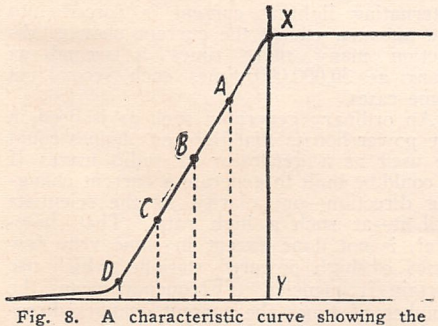


Fig. 8. A characteristic curve showing the effect of high plate voltage.

question which affects our choice of the points A, B and C is the amplitude of the radio- and the audio-frequency currents to be amplified. If the currents are of small amplitude the points A and C will give as good results as the point B, but if the latter point be used, one is certain that, under ordinary conditions, neither bend will be approached by the representative point.

GRAPHICAL REPRESENTATION OF REFLEX AMPLIFICATION

A graphical representation of reflex amplification is illustrated in Fig. 9. In the top line we have shown the radio-frequency currents which are applied to the grid; the second line shows the audio-frequency alternating currents. The actual nature of these two sets of current will depend upon whether spark signals, continuous wave signals, or modulated signals, such as telephony, are being received. The simplest case, however, is illustrated in Fig. 9. The third line shows the effect on the electron flow from the filament to the plate and around the plate circuit. It will be seen that although the general change in the plate current is an audio-frequency one, yet superimposed on this audio-frequency variation we have the exceedingly rapid radio-frequency variation. The diagram is not intended to be to scale, but merely illustrates how the two sets of currents are combined in the plate current of the tube.

The fourth line shows how the audio-frequency currents may be selected in the

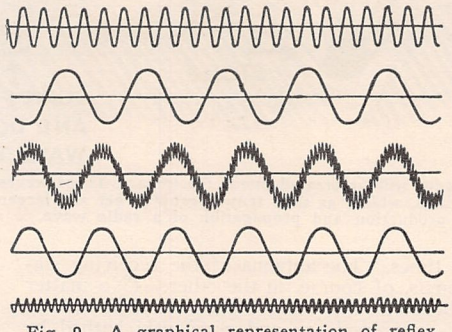


Fig. 9. A graphical representation of reflex amplification.

plate circuit. A method of doing this was shown in Fig. 6, in which a choke coil L_5 is used to choke back the radio-frequency current variations which are superimposed on the audio-frequency current variations, as shown in line 3, Fig. 9. The radio-frequency variations which are choked back by L_5 pass round the other branch circuit and appear in the circuit L_3, C_4, entirely free from the audio-frequency current variations. These selected radio-frequency currents are shown in the fifth line of the Fig. 9 diagram. It will thus be seen that the currents only mix in the third line, *i.e.*, the plate circuit of the tube.

GENERAL PRINCIPLE OF DESIGN OF REFLEX AMPLIFICATION RECEIVERS

Before discussing in any detail the different kinds of reflex amplification circuits and their operation, it is proposed to discuss one or two of the general principles governing reflex circuits.

As in all tube circuits, it is possible to substitute well-known equivalents in different parts of circuits and thereby to produce an almost infinite number of variations. In the case of reflex circuits, however, there is always an uncertain property involved. One can never quite foresee what is going to happen, and a fixed condenser here or there which might not in any way affect the operation of an ordinary tube circuit will radically change the operation of a reflex amplification circuit. With a given set of components, it might be definitely stated that such and such connections would be found most suitable. If, however, an experimenter were to wire up the circuit with different components, entirely different results would be obtained.

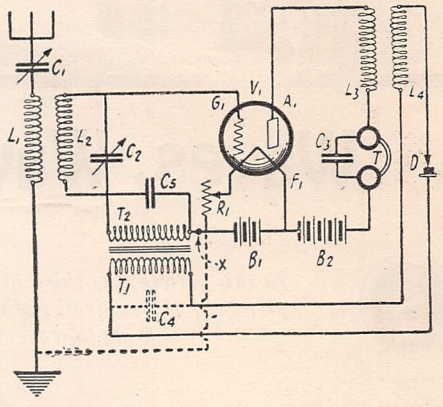


Fig. 10. A simple single tube reflex amplification circuit of excellent characteristics.

The great trouble with reflex amplification circuits is that the tube, which carries out the two stages of amplification, always tend to oscillate at audio-frequency which will usually produce a buzzing noise in the head phones or loud speaker. This is the one great serious fault of reflex amplification circuits, and various means have been suggested to prevent this effect taking place.

There are certain other simple rules which must be observed if the maximum signal strength is to be obtained and if the circuit is to be stable. The principal one of these, apart from the warning against having audio-frequency feed back which may cause buzzing is that batteries, telephones, loud speaker, and the like should all be connected through earth so that their potential is fixed. All designers of wireless apparatus endeavor to prevent storage batteries, "B" batteries, telephones, potentiometers, and other similar pieces of apparatus, particularly those which are of substantial bulk, being placed in a circuit at a point at a radio-frequency potential to earth. The same rules apply to reflex amplification circuits, but in addition we have to add the rule that all such apparatus as that mentioned above should not be allowed to be at audio-frequency potential to earth.

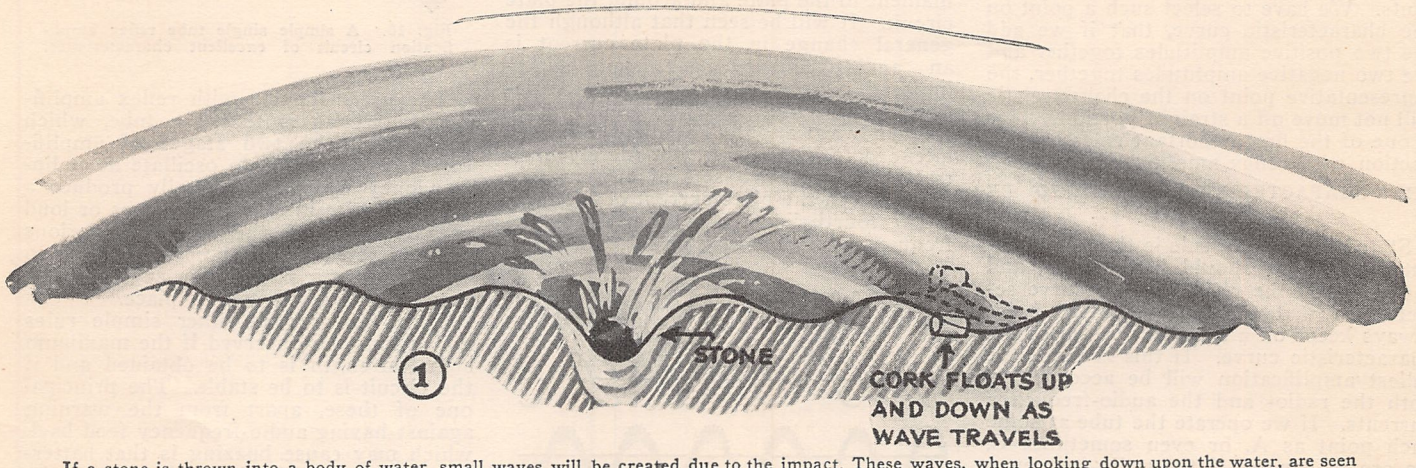
Fig. 10 shows a simple single-tube reflex amplification circuit. This circuit has been chosen because of its simple nature. A loose-coupled circuit is employed for introducing the radio-frequency oscillations from the aerial to the grid circuit of the tube V_1. A variable inductance L_1 is shown in series with a variable condenser C_1, while L_2 is loosely coupled to L_1 and is also shunted by a variable condenser C_2. Both the aerial and closed circuits are, of course, tuned to the incoming wave-length. The radio-frequency oscillations are applied to the grid and filament of the tube, the connection to the filament being made through the condenser C_5, which has a value of, say, .001 mfd. In the plate circuit of the tube we have the inductance L_3, and the head phones T and the "B" battery B_2. The inductance L_3 of the primary of a fixed transformer L_3 L_4 is designed to suit the wave-length to be received. The head phones T are shunted by the fixed condenser C_3 of, say, .002 mfd. capacity for the purpose of by-passing the radio-frequency currents

(*Continued on page* 390)

Waves, Wave-Lengths and Inductance

By A. P. PECK

In this article, the third of a series, Mr. Peck has covered what are probably the most important phases of the subject, radio. In order to understand the more technical points, it is necessary, first, that we have a clear understanding of the fundamentals of radio.



If a stone is thrown into a body of water, small waves will be created due to the impact. These waves, when looking down upon the water, are seen as leaving from the central point in the form of rings, which, as they travel, grow larger and larger in circumference. This is an analogy of the production and propagation of a radio wave.

THE beginner, having constructed the simple radio set described in this department last month, is now ready to learn some of the facts regarding its method of operation; that is, some of the electrical causes which make it function. The action of each piece of apparatus will be explained in the simplest terms possible as well as their relations to each other.

One of the greatest fascinations of radio is the fact—as it is generally put—"that music comes out of the air." As a matter of fact it does not come out of the air. The electrical waves which carry the speech and music are carried through what the scientists call the *ether*.

A word about this: It is not known actually to exist, according to scientists, but it is the best way to explain the action of radio. The scientists say it is a universal medium which pervades everything. It permeates walls or glass or brick, just as water will soak into a sponge. That is why radio waves may be picked up on an antenna strung up inside a building or under ground. No one knows what the ether is like, except that it is capable of transmitting waves. It might be said to resemble a very fine grained jelly—fine grained enough to allow it to flow between the molecules of glass or wood. When a dish of jelly is shaken the jelly vibrates throughout. All parts of it shake. A transmitting radio station simply shakes this supposed universal jelly and the receiving station, being sensitive to waves, is shaken also.

This substance is everywhere. It may be found where there is no air, it is present in a vacuum. In a word, it is *universal*.

A powerful transmitting station simply shakes this ethereal jelly a certain number of times a second, usually, many thousands of times. The antenna of the receiving station is, of course, in the ether. (No matter where it may be placed it will be in this universal sea and constantly bathed by it.) The vibration or waves set up by the transmitter wash up around the receiving antenna, so to speak. This washing up or vibration has a strange effect on the wire of the antenna, it sets up a tiny current within it which is communicated to the receiving set.

How this is done or why, no one knows. It is simply what might be termed a proven fact of science. It actually happens and that is all we know. The fact remains, however, that when the transmitter shakes or vibrates this universal medium, the vibrations travel in all directions through the universe for thousands of miles in all directions. The distance the vibrations travel before dying out, of course, depends upon the power of the transmitter—the strength with which it is able to shake the ether.

THE WAVES

The waves are more or less like the waves on top of a pond. When one throws a stone into a body of placid water there are ripples formed as illustrated in Fig. 1. The water moves up and down. Now if a stone were thrown into the water and there was a cork floating several feet away from the point where the stone was thrown, the water ripples produced by the stone would cause it to bob up and down with the waves. If this cork were attached to an arm and if the arm were connected to the smallest sort of an electric generator, the whole thing might be likened to the radio receiving station. The up-and-down motion of the water waves would be communicated to the arm through the cork; and the arm, in turn, would work a pulley connected to the generator and the generator would produce a very small electric current.

The currents we deal with in radio are alternating. That is, they travel on a wire first in one direction and then in the other. They make this change many thousands of times a second. Likewise, they will change their direction of flow in all the other parts of the set until they pass to the detector. What the detector does will be explained later. For the present, however, we will deal with the currents flowing first in one direction and then in the other.

It is this sort of current which, when forced into an antenna causes the ether to shake. This current is exactly like that used to light our homes and run our mills, except the flow changes directions much more often. Who has not seen the notation on motors or electrical appliances about the house, "60 cycles"? This means the instrument is built to be used on currents which change directions—flow first one way through the conducting wires and then the other—60 times each second. At the radio transmitting station a current just like our alternating lighting current is forced into the antenna, except the current changes direction many more times a second—as many as 30,000,000 times each second, in some cases.

An ordinary generator such as is used in the power houses that light our homes could be used as a generator of radio waves if it could be built to generate a current changing direction—or polarity, as the scientists call it—at such a high rate. That, however, is not done except in some very few cases of high powered stations, which use certain frequencies. (Frequency means the number of times the current changes direction each second, such as 60 cycles frequency,

meaning changing direction 60 times each second.)

ABOUT "NATURAL PERIODS"

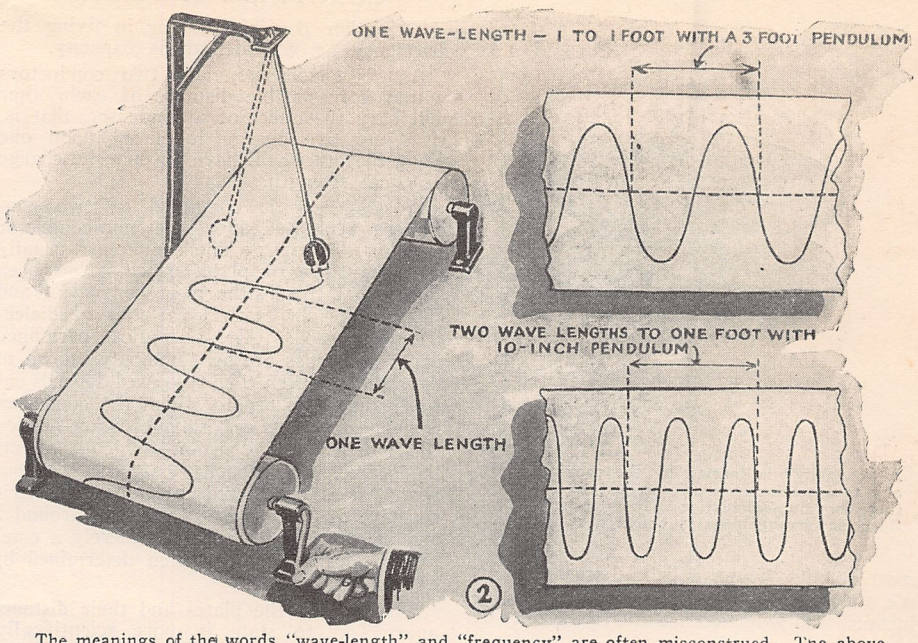
Now an analogy. Consider the pendulum. All of us know that a pendulum swings backward and forward a certain number of times a second. The number of times each second it will pass backward and forward will depend upon the length of its arm. This is one of the well known laws of physics. A short pendulum will swing many times a second, while a long one will swing only a few times.

Now imagine a pencil attached to the bottom of the pendulum and a piece of paper being drawn under it in a direction at right angles to the way the pendulum swings. Imagine the paper passing under at always the same speed, say a speed of one foot per second. If a pendulum about three feet long were used, each foot of paper would show a line representing one complete cycle, that is, the line drawn by the pencil would begin at the center line, extend far out to the right, reverse, cross the center line again, swing out far to the left, reverse and come back to the center line one foot away from the beginning point, as illustrated in Fig. 2. This curved line would be repeated every second until the pendulum stopped. It might not swing so far out; in fact, as the pendulum gradually lost speed, the curve would come closer and closer to a line drawn midway between to furthest point reached to the left and the furthest point reached to the right, but no matter how nearly the curve approached the center line it would always take a *foot of the paper* for the pendulum to complete a full swing to the right and left. Never any more or less.

Now, if we change the length of the pendulum, matters will be different. If we use a shorter pendulum we will get many more complete cycles per foot, with the paper still passing under at the same speed. Suppose we choose a pendulum about 10 inches long. In that case, each foot of the paper will contain two of the complete cycles, as illustrated in Fig. 2B. Each of the complete curves—one complete swing to the right, followed by a complete swing to the left—will be six inches long instead of one foot long, as in the case with the first pendulum. If the pendulum were close to 23 inches in length each of the complete curves would be nine inches in length.

Suppose we have an alternating current of high frequency pushing first one way and then the other in a transmitting antenna. This frequency is just like the pendulum frequency, complete swings. The alternating current sets up waves in the ether.

The scientists say that all waves in the ether travel at the fixed speed of light, viz., 186,000 miles (300,000,000 meters) per second. This fixed speed is like the fixed speed of the paper traveling under the pendulum. Thus, the wave-length of the radio wave depends upon the frequency of the



The meanings of the words "wave-length" and "frequency" are often misconstrued. The above sketches should serve to illustrate. With the paper moving at a constant speed, the number of wave forms drawn upon it for a definite length, will depend upon the rapidity with which the pendulum moves to and fro, and this is also dependent on the length of the pendulum arm. The longer this arm, the greater the length of the wave form will be and the lesser the number of waves drawn on a definite length of the paper, and vice-versa.

alternations, because the etherial impulse is always 186,000 miles—or 300,000,000 meters—from the transmitter at the end of the first second. That is, it would be if the station had sufficient strength to force out so strong a wave.

But there is a change in the etherial impulse for every change in direction of the current in the antenna, just as there was a crest and trough marked on the moving paper, or as there was a crest and trough in the water wave. It is the distance from the top of one crest to the top of the next that is called the wave-length, as shown in Fig. 2. Now, since the undulatory motion in the ether travels at the rate stated, at all times, the distance from the top of one crest to the top of the next (or from the point midway between where the line drawn by the pendulum crosses the line drawn in the center of the paper to the corresponding point after one complete reversal of current) is dependent upon the frequency with which the transmitting current changes directions making undulations in the ether. Thus, to find the wave-length we divide the speed of travel—186,000 miles per second—by the frequency.

Wave-length is one of the most useful attributes of radio. It enables us to hear one station while another is transmitting because we may tune a receiver to one definite wave-length and all other waves will pass over and not affect the instruments.

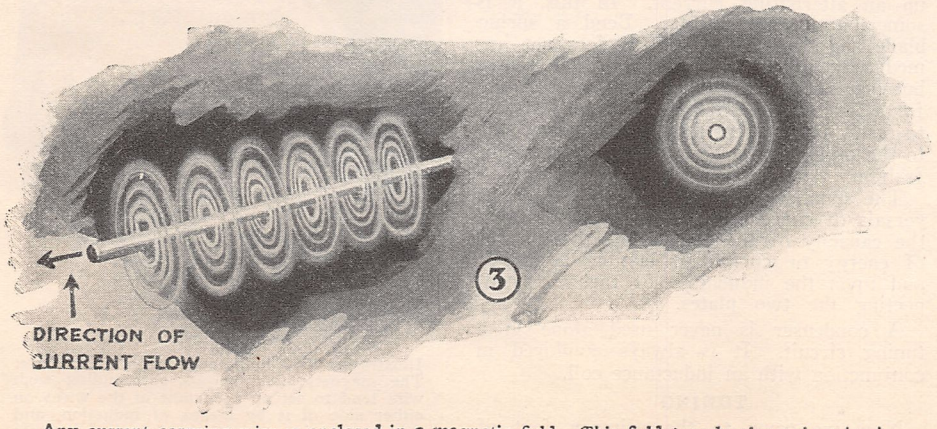
What has preceded has been a discussion of wave-length, itself. More germane to the operation of radio apparatus is the fact that all electrical circuits have a natural period (or a natural rate of vibration at which they work more efficiently than at any other) just as every pendulum has a natural period. This period is determined by two attributes of the circuit known as its capacity and inductance. Each of these is discussed below.

INDUCTANCE

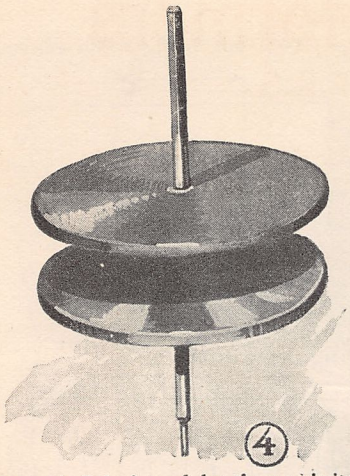
First consider inductance. Every one knows there is what is called a magnetic field around a wire which is carrying a current. If a compass is placed by the side of a straight wire through which a current is traveling, the needle will set itself parallel to the wire because of the magnetic property of the wire carrying the current. (See Fig. 3.) It is said that there are a number of "magnetic lines of force" surrounding the wire. These lines begin when the current is first passed through the wire. It is supposed that they travel like expanding circles. When the current begins they are very small; as it increases they grow larger, always remaining concentric with the wire. Then when the current stops they fall or collapse into the wire just as they grew. When the current begins to drop so do the lines of force. (They are directly related to the current and conduct themselves according to the actions of the current. If the current jumps so do they. If the current remains steady they are quite staid and remain of a constant amplitude.)

This is how the lines of force come about. They have a greater number of effects. For instance, if, in expanding as the current builds up, they must pass through another wire, they will cause a current to flow in the other wire. As a matter of fact, all our commercial electricity is made by the simple method of hurrying a large number of wires through many millions of these lines of force set up by other coils of wire.

In radio we have many coils of wire, all of which are affected by these lines of force which are always present when there is a current. There are two uses made of this action. One of them is called self-inductance—or just inductance—and the other is called induction. The former affects wave-length, which is so all-important in radio. The latter has several uses which we could not do without very well in radio, but which do not affect wave-length to any



Any current carrying wire is enclosed in a magnetic field. This field travels along the wire in spiral fashion and travels to the left or to the right, depending upon the direction of the current flow. The extent or circumference of the spirals is dependent upon the strength of the current.



A "capacity" is formed by the proximity of any two conductive surfaces just so long as there is a non-conductive space between them. Such an arrangement is called a condenser.

great extent. These will be discussed later. We must keep in mind though, that both inductance and induction are due to the lines of force.

As was stated, whenever the lines of force from one wire cross or cut another wire, there is a current made in the second wire which depends in strength upon the power of the lines of force. We know the strength of the lines of force depends upon the current in the first wire, so it is obvious that the current in the second wire will be directly proportional to that in the first. Also, its direction will have a certain fixed relation to the direction of the current in the first.

Consider a coil of several turns of wire wound upon a cardboard or other tube—a coil like the primary or the secondary of the variocoupler described last month. When a current starts through the coil it sets up the magnetic lines of force around the wire throughout its entire length. Now, because the wire is wound in coil shape, the circular lines emanating from each turn on the coil must pass through most of the other turns—at least some of them, for, of course, the number of turns the lines pass through will depend upon the strength of the current because their strength depends upon it. This is illustrated in Fig. 5.

The scientists have discovered that the current induced in an adjacent turn of a coil (such as the stator coil) will be in the opposite direction to the current in the previous turn which set up the lines of force when the current starts to flow. Thus, any coil tends, when a current first begins to pass through it, to oppose the current, to hold it back. The opposite is the case when the current begins to stop. Then, the lines of force try to keep the current flowing, and boost it up when it begins to die.

In radio, this attribute of a coil is very important for we are dealing principally with alternating current, and alternating current is constantly building up from zero to a maximum and then falling off to zero, then building up to a maximum in the opposite direction and then falling off, and so on, as long as the current flows. Since the current is always changing—and it is never stationary, at one value, in alternating currents—the lines of force are changing, are growing larger and larger and then becoming smaller and smaller and then doing the same thing in the opposite way. From this it is obvious that inductance (or self-inductance) is having a very definite and constant effect all the time.

It is this business which a coil constantly engages in, this constant attempt to keep the current the same, its opposal of a current when it is building up, and helping it along as it drops, that has so great an effect on the wave-length or frequency, in radio.

CAPACITY AND CONDENSERS

The other powerful factor in fixing the frequency or wave-length is capacity.

As to condensers, any two conductors within a reasonable distance of each other will have the effect of a condenser, that is, if a negative charge is placed upon one plate, the other will have an opposite charge of equal strength.

A condenser is composed of two conductors separated by some non-conductor called a *dielectric*. The conductors usually take the form of plates, since it has been found that this is the most convenient and efficient form. Several varieties of dielectrics are used. Air, oil, mica, paraffined paper and glass are all commonly known to the radio engineer. The type used depends entirely upon the use to which the condenser is put. Each has a certain constant—called the dielectric constant—which affects the value, or capacity, of the condenser. Air is considered to have a dielectric constant of 1, mica has a constant around 5 and oil even larger. This is merely a comparative value and has been determined by enginers.

The size of the plates and their distance apart (or, to state it more scientifically, the thickness of the dielectric between them) also have an effect upon the capacity, which is measured in *farads*.

Power Without Wires

Is it possible to transmit power at a distance without wires? It is! This is not a theory, but a number of very interesting experiments over short distances are described in the September issue of PRACTICAL ELECTRICS by Mr. Esten Moen. Anyone with existing apparatus is able to light small lamps over short distances. Every reader of RADIO NEWS will be interested in this article. Do not fail to get this important issue.

Interesting Articles to Appear in September Issue of "Practical Electrics"

French Million Volt Laboratory.
The Most Amazing Stuff on Earth.
By Esten Moen.
Testing Metals with Roentgen Rays.
By Dr. Franz Fuchs.
Floodlighting Madison Square Garden.
Solar Thermo Electric Battery.

When a charge is placed upon the plates of a condenser and they are connected together, the charges flow from one plate to the other, finally equalizing themselves so there is no more charge on either of them. This process is commonly known as discharging the condenser. The charge may be likened to water, it seeks its own level. When the condenser plates are connected for discharge, the current does not rush across immediately but "oscillates," that is, it sets up an alternating current. In this, it is somewhat like a spring. Bend a spring blade and then release it. It does not immediately go back to its original shape, but bends further. It will swing back and forth for a number of minutes before coming to rest. The current flowing from one plate to the other in a condenser acts in the same fashion.

The number of these oscillations or reversals of current per second depends upon the capacity of the condenser (the amount of energy or current it is able to store) and upon the inductance of the wire connecting the two plates.

A condenser is never used alone in a tuning circuit. It is always employed in conjunction with an inductance coil.

TUNING

Now we come to the primary fact of tuning. Every condenser and inductance (coil) connected together have a natural period of vibration just as a pendulum. This period is amenable to certain laws. The period (which is to say the number of oscillations or reversals of current per second) depends upon the inductance of the coil and the capacity of the condenser. If either of these is changed, the period of the circuit is changed. That is, a circuit containing a condenser having a certain value of capacity (measured in microfarads) and a coil having a certain value of inductance (measured in milli-henries) will have a definite frequency or natural period of vibration of its own. Change the value of either the condenser or the coil and immediately the natural frequency of the combine is altered.

APPLICATION OF THEORY

So we see it is comparatively easy to tune a set simply by changing the value of the condenser or the inductance. Usually the condenser is the variable element, so made that its capacity can be increased or decreased at will.

By tuning we mean, of course, changing the natural period of the coil-condenser circuit. By natural period we mean the certain frequency to which a circuit with a definite setting for capacity and inductance will respond with most efficiency. At this period it takes very little energy to make the circuit oscillate—its resistance to the currents flowing at the natural frequency will be very small. To other currents, not of the natural period the resistance will be very great—will give the current so much opposition that it will not flow at all. And the further from the natural frequency the incoming current lies the greater will be the resistance of the circuit to it.

Each broadcast station sends out waves of a certain length—generates waves in the ether as told at the beginning of this article, which set up a current of a definite number of vibrations per second, in the receiving antenna. It is because of this that we must have a tunable receiver. It must be so constructed that the inductance of the coil and capacity of the condenser may be varied so that the natural period of the receiving set corresponds to the natural period of the transmitter.

Here, let us say, parenthetically, that the individual turns of wire on the coil act as a condenser. Its capacity is minute, of course, but a condenser it is, nevertheless, and is possessed of a capacity just as much as a

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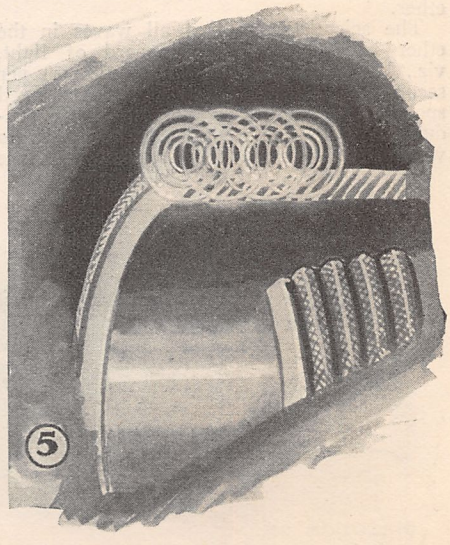


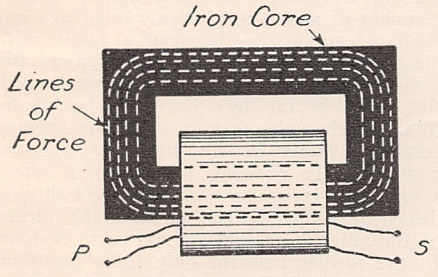
Illustrating "self-inductance" in a coil of wire. The magnetic field spirals surrounding each wire tend to set up a current in the wires on either side of it by means of induction, and this current is set up in a direction opposite the original current flowing in each wire.

The Use of Iron In Transformers

By SIR OLIVER LODGE, D.Sc., LL.D., F.R.S.

Sir Oliver Lodge points out the good and bad effects of numerous forms of iron cores in transformers in a manner that can be understood by all. No technical words are used that are not explained.

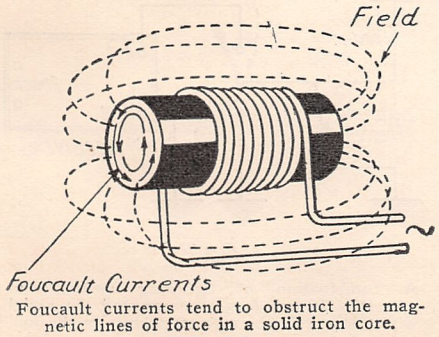
IRON when used as the core of a transformer or any kind of induction coil has two chief properties, i. e., magnetization and conduction, in which it differs from any of the other ordinary metals, which practically have only the property of conduction. When a varying current circulates around in ordinary metal, it induces short circuited opposite currents



An iron core is superior to an air core, as iron is a better conductor of magnetic lines of force than air.

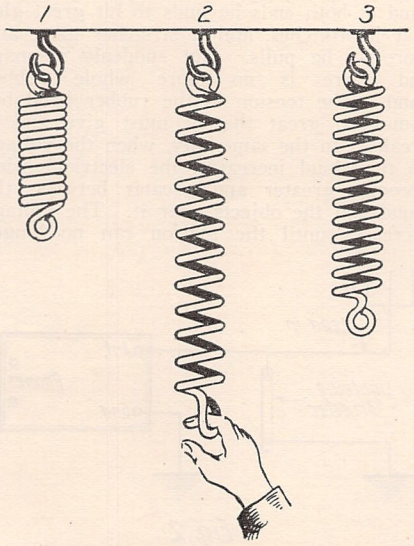
in the substance of that metal, and these secondary currents react on the primary circuit, in a way which is most simply described as increasing its effective or apparent resistance and diminishing its effective or apparent inductance. In this respect iron has the same properties as other metals, except that it is not so good a conductor as some of them, and hence secondary induced or so-called Foucault currents are not so strong in iron as they are in copper; but otherwise they are just the same, in kind though not in degree.

Iron, however, has the additional property of being magnetizable, but so long as these Foucault currents last, they tend to screen it from the magnetizing effect of the primary current, since they are opposed in direction to that current. They, therefore, delay the magnetism, and at high frequency might protect it altogether, acting as a sort of screening skin, so that hardly any magnetic lines of force are generated inside the iron. This screening action would certainly take effect at what in radio practice is known as "high frequency." But at audio frequencies the Foucault currents would have time to subside, killed by the high resistance of the thin skin in which they circulate; magnetic lines of force would have time to develop, and the iron core would be magnetized and de-magnetized, or reversed in magnetism, in accordance with the fluctuations of the exciting current, though with a certain amount of lag.



Foucault currents tend to obstruct the magnetic lines of force in a solid iron core.

Of course the Foucault currents must be kept to a minimum by subdividing the iron. It would never do to use a solid core or a core built up of cylinders one inside the other, or of disks screwed up together so as to make a cylinder, because in either a cylinder or a disk the Foucault currents would have a free path for circulation, and the interior of the iron would hardly become magnetized at all. The core must be subdivided laterally, not longitudinally, and for this reason it is usually built up of a bundle of thin iron wires, which though incompletely insulated from one another (because insulation would take up valuable room), may yet be varnished, or at any rate slightly coated over with sufficient oxide, to prevent free electrical circulation or passage of current from wire to wire. Their longitudinal continuity is necessary for the magnetic lines of force; their lateral discontinuity is necessary for the stoppage of induced currents.



Hysteresis is likened to a spring which when drawn from its natural position 1 to the position of 2, will remain as in 3 instead of returning to that of 1.

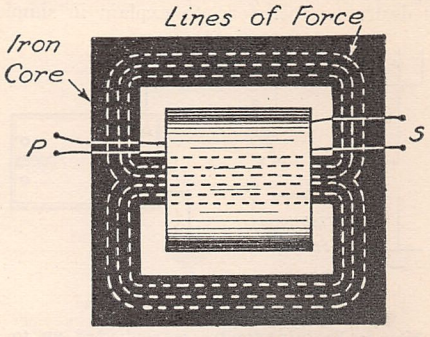
It is true that some transformer cores are made of thin sheet stampings, but the plane of these stampings is always at right-angles to the plane of the primary coil. The stampings being in the form of disks with the center part cut away, the windings of the primary circuit are taken through the center hollow of the disks and back to the outside, so they are continuous only in a direction at right angles to the current, and are not continuous in the direction of the current itself.

All this is probably well understood. Certainly it is understood by instrument makers.

Iron has another property called hysteresis. This means that its rise and fall in magnetism are not quite similar. It rises, as it were, by one path, and falls by another. The rise of magnetism, when plotted, follows what is called the "magnetization curve." The fall follows a similar but not identical curve; so that the two curves, when plotted, enclose a large area, when the magnetization and demagnetization are fairly complete.

If the magnetization and demagnetization are only partial, the two curves will still enclose an area, but not as large as in the former case.

Wherever curves of this kind enclose an area, it means that work is done during the magnetization which is not got back



An iron core of this type, with the leg in the center is even more efficient since it allows two paths for the lines of force.

during the demagnetization. There is loss or waste of energy. If the up-and-down paths were identical, there would be no loss, but when they differ from each other, it is like imperfect elasticity; you don't get back from the spring all you put into it. You never get more, and you may get less. The difference or the loss at each cycle is represented by the area enclosed between the two curves. The fatter this area, the more the hysteresis. In fact, hysteresis may be considered as the name given to this area, the loss of energy per cycle.

IRON LOSSES

Some kinds of iron have much less hysteresis than others, but there is always some, and accordingly an iron core does involve some loss. However, the advantages due to its extra magnetic lines of force are so great as to overwhelm this loss and give us a balance of advantage, if the number of cycles is not too great.

The loss in commercial transformers at a frequency of 50 or 100 per second is by no means insignificant. It results in heat, which is always the outcome of waste energy, and the transformer must be kept cool artificially. At a frequency of 1,000 cycles per second, the loss is greater, but inasmuch as the magnetization is probably more feeble, the area per cycle is likely to be less. And so for audio frequencies, such

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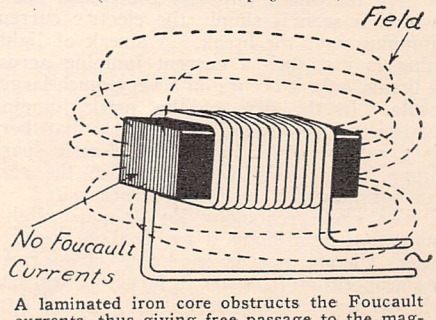

A laminated iron core obstructs the Foucault currents, thus giving free passage to the magnetic lines of force.

The Myth of Summer Lightning

By M. WOLF

Again we wish to emphasize, through the medium of Mr. Wolf's article, the fact that the use of an aerial in nowise endangers a person or a house from lightning, any more than the telephone and electric light wires. Mr. Wolf here explains the whys and wherefores very clearly.

AT some time during this, our radio era, someone issued the edict that it was dangerous to operate radio sets during the summer because of the frequent occurrence of lightning storms. As sure as the seasons roll by so sure are people taken in by this erroneous notion, especially at this time of the year. This notion is a pure myth, founded, most likely, on ignorance. It is extremely desirable, therefore, to explain in simple terms the entire subject of lightning as it is related to radio broadcast reception, and at the same time to explode this myth.

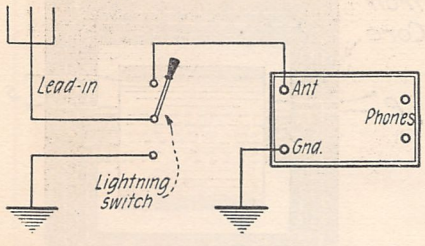

Fig. 1

How a lightning switch is connected up to the aerial and the receiving set. Note that a separate ground connection is employed for the purpose of protection.

It is of interest to note that this feeling towards lightning is at its height during the summer period. Yet it is a fact that lightning storms occur during all seasons of the year and no mention is made of them except during the summer season. And the fact that they occur during other seasons of the year without harm or injury to radio receivers or operators should convince anyone that radio receivers and listeners are not the special subjects of persecution of the gods of lightning. Two big radio summers have passed and yet we have seen no lists of radio calamities brought on by lightning. In fact, the records show that houses having radio antennae have been immune from lightning damage, whereas houses not so equipped have suffered damage in lightning storms. There is a very good reason why houses with radio antennae are, to a considerable extent, immune from lightning hazards and this reason will be brought out through this article.

What is this thing called lightning, anyway? How does it occur? Most everybody has seen an electric spark. When an electric switch opens a circuit, a small spark is seen to pass or jump across the switch for an instant. The electric voltage at the break of the switch is sufficient to just jump across the small gap and the bluish spark which is seen is simply the electric current jumping over the break. A streak of lightning is just such a current jumping across a break, only it occurs on a very much larger scale. In the case of the spark jumping across the opening switch we know that there is a voltage which makes the electric spark jump. Where is this voltage in the case of lightning and how does it originate?

The small schoolboy knows when lightning flashes, a cloud is involved in the process. Clouds, as everyone knows, are formed by evaporation of water in large masses. As the evaporated water rises in the atmosphere, it begins to condense and science shows that it generally condenses around the particles of dust which are ever present in the atmosphere. The interesting feature about this condensation of water around dust particles is that there is an electric charge associated with each globule of water thus formed. The amount of the electric charge on each globule of water is extremely small. But the large white clouds that one sees in the upper atmosphere are made up of billions and billions of small water globules, and the electric charge which, therefore, piles up on the cloud becomes greater and greater until really enormous magnitudes are reached. As a result of this great electric charge which accumulates on the cloud, there is established a tremendous voltage between the cloud and any other body near it, as for example between the cloud and the earth, or between the cloud and another cloud.

The voltage which accumulates on a cloud cannot increase indefinitely, for the same reason that one cannot stretch a rubber band indefinitely. When a child pulls a rubber band at both ends he finds to his great glee that it stretches, and it stretches more and more as he pulls. But suddenly it snaps and there is no more whole rubber band. The tension in the rubber band becomes so great that it must give and it breaks. In the same way, when the voltage on the cloud increases, the electric tension becomes greater and greater between the cloud and the objects near it. The voltage increases until the tension can no longer maintain itself and a huge spark leaps from the cloud to the earth, or other cloud, or other object near it. This spark is lightning and it has in effect relieved the enormous electric tension which existed.

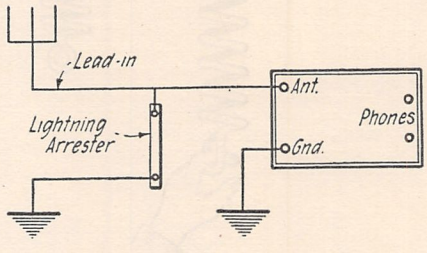

Fig. 2

How a lightning arrester is connected up. This will take the place of the lightning switch.

The neophite might explain that for the reason telephone, telegraph and power wires have an insulating covering which fully protects them from the ravages of lightning. This is not so. If lightning is going to strike a wire, it will do so, regardless of any insulation covering.

Like everything else in this world of ours, lightning moves along the path of least resistance. It strikes those objects nearest the cloud from which the lighting charge takes place. Advantage may be taken of this fact to protect buildings and other structures from the ravages of lightning. The lightning-rod is an illustration of this. A lightning-rod extends to some height above the topmost point of a building and, as it is metallic, attracts the lightning stroke to it. Since the lightning rod is connected directly to the ground the lightning discharge travels to ground where no harm is done. It will be apparent that in this case a path of very low resistance is offered to the lightning stroke, and the object of the lightning rod is to divert the lightning from points where great harm may be done, as from buildings, etc., to points where no harm is done.

Now, what is the bearing of this on radio? People who like to frighten others say that the presence of the antenna invites lightning to strike the house on which it is erected. A knowledge of the simple principles enumerated above conclusively disproves any such assertion. As between a house with no antenna and no lightning protection, and a house with an antenna properly grounded, the latter is far less likely to be hit by lightning than the former. For the antenna behaves exactly as the lightning rod explained in the previous paragraph, it offers a very low resistance path for the lightning discharge which is run to earth by means of the antenna ground and no harm is done. In the former case the only thing lightning may strike is the house. Instances have been known where, of two adjacent houses, one with an antenna and one without, the one without the antenna suffered a lightning stroke, whereas the house with antenna was untouched. That this is likely to be the case must be evident from a knowledge of the action of the lightning rod; and *the antenna well grounded is a lightning rod.*

Why people should believe the antenna susceptible to lightning strokes is very difficult to understand. The antenna is a simple wire leading into an electrical instrument located inside the house; so is a telephone wire. The telephone wire comes from the outside into an electrical instrument similar to a radio set inside the house. Yet we do not hear a cry raised against the telephone for attracting lightning. Telegraph wires and power wires also come from the outside to the inside of the house, yet these are not more subject to lightning because of it.

As we pointed out above, however, the antenna must be well grounded. This is best accomplished in the very simple way of using a lightning switch. An ordinary porcelain base 30-ampere switch of the single pole, double throw type is quite satisfactory. The method of using it is shown in Fig. 1. The middle post of the switch is connected to the lead-in of the antenna, the top post to the antenna post of the receiving set, the bottom one to the ground. When the switch is thrown upwards the antenna lead-in is connected directly to the receiver. When the set is not in use, the lightning switch is

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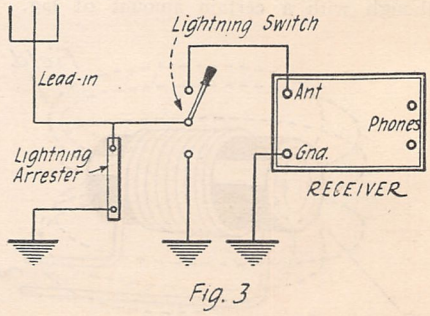


Fig. 3

A combination of lightning switch and arrester. If one forgets to ground the aerial with the switch, the arrester is still on the job.

A Six Tube Receiver of Advanced Design

By THE TECHNICAL STAFF OF RADIO NEWS

The first portion of the circuit of the receiving set described in this article is along the lines of the Teledyne receiver in which advantage is taken of both regeneration and radio frequency amplification. The audio frequency amplification is novel.

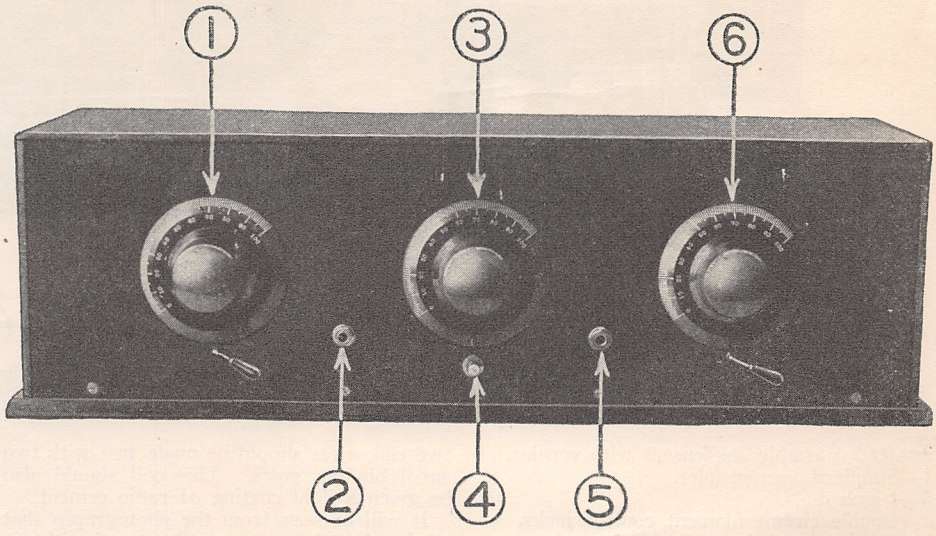
A GREAT many radio fans at the present time are willing to add two extra tubes to a receiving set in order to secure real quality. With this thought in mind, RADIO NEWS constructed the receiver about to be described. It has quite a few assets: Non-radiation, selectivity, covers all broadcast waves, ease of control, quality of reproduction, good volume and appearance.

Radiation is very annoying these days on account of the great congestion. Everyone, at one time or another, has experienced the squeals and howls sent out from some neighbor's regenerative receiver. There have been a great many claims made by manufacturers stating their product will not radiate. With few exceptions, their claims are exaggerated, as there are very few real non-radiating circuits. In the receiver to be described, there is one stage of tuned radio frequency. In the plate circuit of this tube there is an untuned winding of four turns placed over the grid coil of the detector circuit. The detector circuit can oscillate freely without even the nearest neighbor being disturbed.

As a result of tests made in various locations in and outside New York City—the most congested radio center in the world—not the least bit of trouble was experienced in bringing in distant stations through the locals. WCAE, on 462 meters, and WRC on 469 meters were brought in on the loud speaker at any time without the least interference from WJZ on 455 meters or WEAF on 492, as well as WOO or WIP on 509 meters, provided there is not too much static.

This set has a range of 200 meters to 550 meters and has the same dial settings at all times for a given station.

Quality reproduction is often sacrified for volume, but owing to the one stage of transformer coupled A.F. and one stage of resistance coupled A.F., ordinary volume is secured without distortion, while the one stage of push-pull A.F. gives a good boost to the signals without distorting them. Any station that can be heard clearly on the phones can be heard on the loud speaker with good volume.



A front view of the receiving set described in this article. No. 1 is the aerial tuning dial; 2, the detector jack; 3, the dial controlling regeneration; 4, the filament switch; 5, the audio frequency amplifier; and 6, the dial for tuning the radio frequency amplifier.

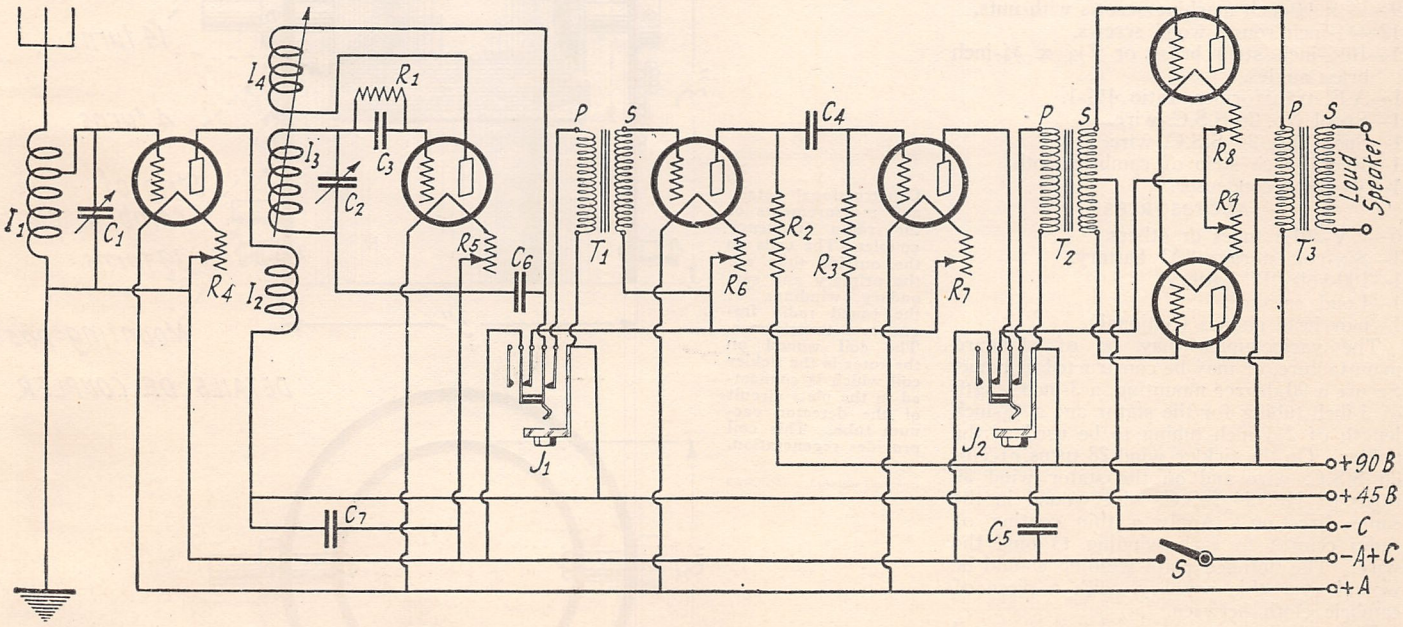
Numerous dials and controls make themselves conspicuous by their absence. No filament controls are visible for the reason that automatic devices are employed. Six vacuous current adjusters and two filament control jacks care for this important factor.

In spite of the fact that the set contains six tubes, it is not particularly difficult to construct if properly laid out. Instead of connecting wires this way and that, without any lay-out or planning, a little thought regarding the lay-out will save time and result in better appearance and operation.

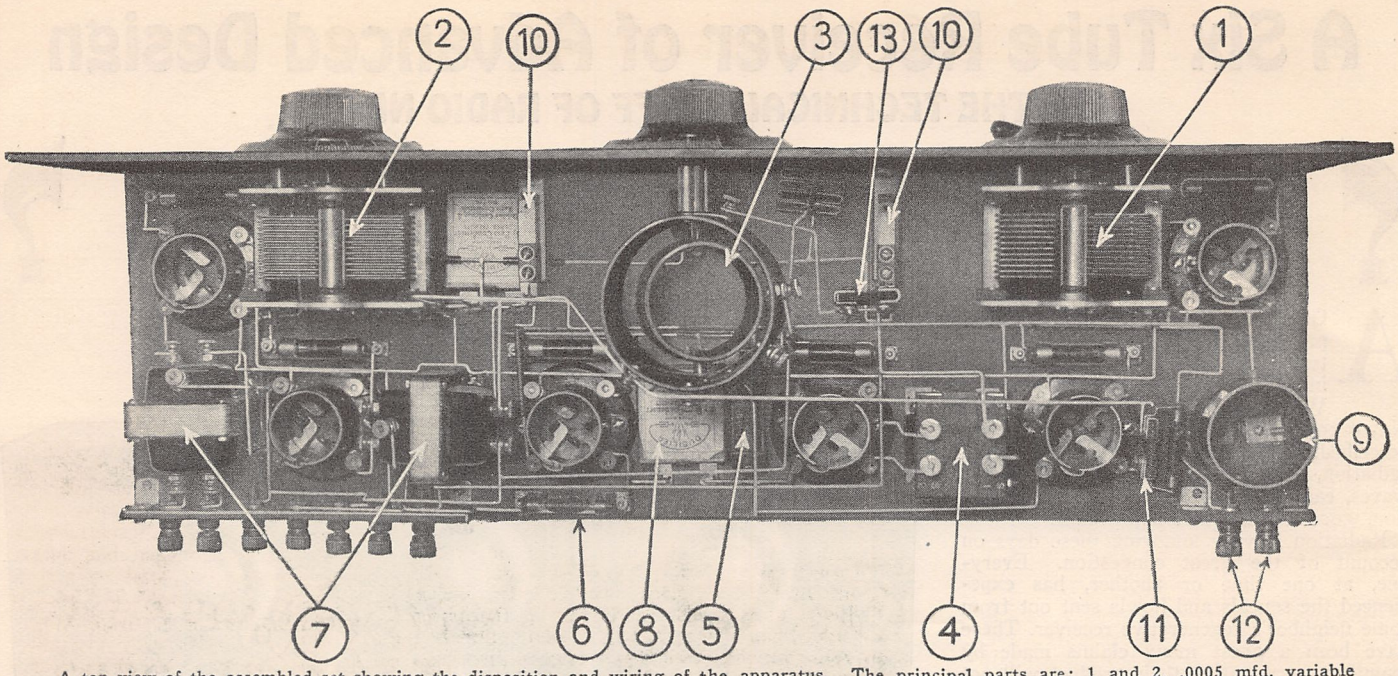
The first thing to do in building any set is to secure all the necessary material before work is started.

BILL OF MATERIAL

1—7 x 24 x 3-16 inch hard rubber or bakelite panel.



SCHEMATIC DIAGRAM OF THE SIX TUBE RECEIVER. The key to the diagram is as follows: I1, 68 turns of No. 26 S.S.C. wire with tap at 15th turn; I2, four turns of No. 24 S.S.C. wire insulated from I3 by a strip of cambric cloth; I3, 39 turns of No. 24 S.S.C. wire; I4, 30 turns of No. 26 S.S.C. wire; C1-C2, .0005 mfd. vernier variable condensers; C3, .00025 mfd. fixed mica condenser with leak clips; C4-C5, 5 mfd. by-pass condensers; C6, .00025 mfd. fixed condenser; C7, .04 mfd. by-pass condenser; R1, 2-megohm grid leaks; R2, 48,000-ohm lavite resistance; R3, ¼-megohm grid leak; R4, R5, R6, R7, R8, R9, fixed resistances for 201A type tubes; T1, audio frequency transformer with ratio of about 4½ to 1; T2, input push-pull transformer; T3, output push-pull transformer; J1, J2, double circuit filament control jacks. The negative terminal of the "B" battery connects to the post on the diagram marked +A.



A top view of the assembled set showing the disposition and wiring of the apparatus. The principal parts are: 1 and 2, .0005 mfd. variable condensers; 3, radio frequency coupler; 4, audio frequency transformer; 5, 48,000-ohm resistance unit; 6, grid leak; 7, push-pull transformers; 8, fixed condenser; 9, aerial tuning inductance; 10, jacks; 11, grid condenser and leak; 12, aerial and ground binding posts; 13, fixed condenser.

2—.0005 Variable condensers with vernier.
1—Standard variocoupler.
3—4-inch dials.
2—Double circuit filament control jacks.
1—Filament switch.
1—7 x 23¼-inch baseboard.
6—Tube sockets.
6—Amperites No. 1A for 201A tubes.
1—Resistance (48,000 ohms.)
1—.00025 fixed condenser.
2—.5 mfd. fixed by-pass condensers.
1—.00025 fixed grid condenser with clips.
1—2 meg. fixed grid leak.
1—Grid leak mounting.
1—¼ meg. grid leak.
1—2 x 3-inch bakelite tube.
1—7 x 1 x 3-16-inch strip of bakelite.
1—2½ x 1 x 3-16-inch strip of bakelite.
20—2-foot lengths of bus bar.
1—3-foot length of cambric tubing.
9—Medium size binding posts.
4—1-inch flat head wood screws.
27—⅝-inch round head wood screws.
6—⅝-inch flat head wood screws.
9—½ x ⅛-inch machine screws with nuts.
12—¾-inch round wood screws.
1—10½-inch strip brass or 7¾ x ¾-inch brass angles.
1—A.F. transformer, ratio 4½-1.
1—Spool No. 26 S.S.C. wire.
1—Spool No. 24 S.S.C. wire.
1—10 x 1-inch strip of cambric cloth.
1—.04 fixed condenser.

ACCESSORIES

6—UV-201A tubes or others.
1—Six-volt storage "A" battery.
1—100-volt "B" battery.
1—Loud speaker.
1—pair head phones (optional).

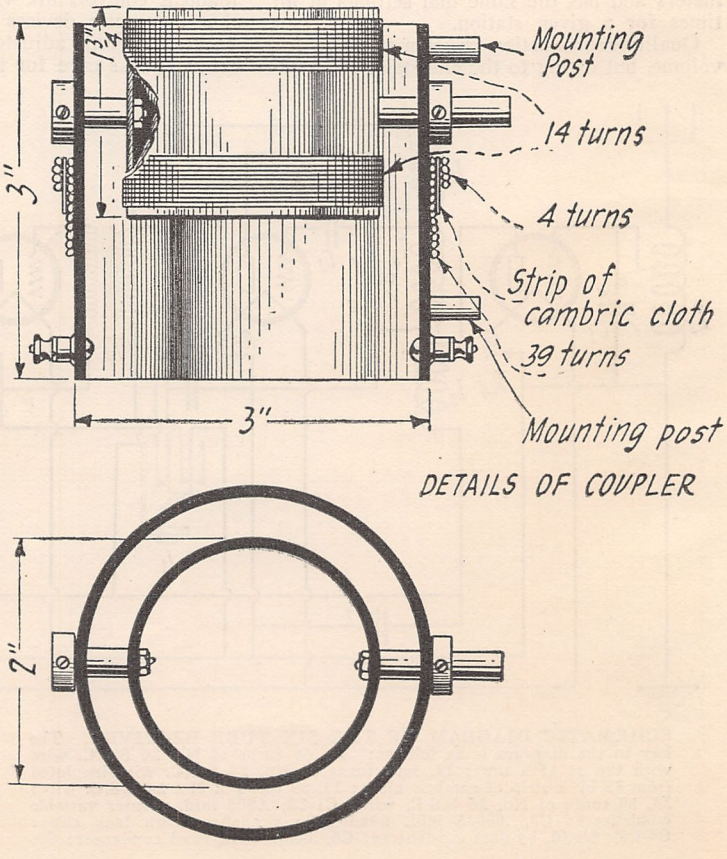
The variocoupler may be of standard manufacture, or may be constructed at home. Secure a 90-degree mounting, a 3-inch length of 3-inch tubing for the stator and a ¾-inch length of 2¼-inch tubing to be used as the tickler. On the tickler wind 28 turns of No. 26 S.S.C. wire and on the stator wind 39 turns of No. 24 S.S.C. wire wound in the same direction. Apply a thin coating of radio cement to each winding to bind the wire. The untuned plate winding should be wound over this primary, with a piece of cambric cloth between.

The winding on the aerial tuning coil should be started ½ inch from the bottom of the tube and tapped at the 15th turn and continued for 53 turns, wound in the same direction, making a total of 68 turns. Number 26 S.S.C. wire should be used. The two end wires should be made fast with two small binding posts. This coil should also be given a light coating of radio cement.

It will be seen from the photographs that the baseboard is pretty well covered with apparatus and also that all the wires with one or two exceptions are short. Lay out all the apparatus on the baseboard in the same manner as is shown in the diagram and fasten down with screws. Mount the bakelite strip holding the binding posts with two brass angles in such a way that the posts will protrude from the back of the cabinet when the set is completed. The aerial tuning coil is fastened to the board by two small brass angles which are first made fast to the tubing by ½-inch machine screws. Be careful not to mix up the push-pull amplifying transformers, as they are identical in appearance.

If a grained panel is desired secure a good table or bench, 10 cents worth of pumice powder, a can of lubricating oil and some rags. Pour a few drops of oil here and there on the surface of the panel and sprinkle pumice powder over it. Try as much as possible to rub in straight lines, because nothing looks as bad as a panel which is grained in several directions. A little extra care and time will result in a much better job.

Use the templates furnished by the manufacturer of the condenser for marking the holes for the mounting screws. Drill the holes as accurately as possible and countersink them deeply enough for the screws to clear the dials. If a regular countersink drill

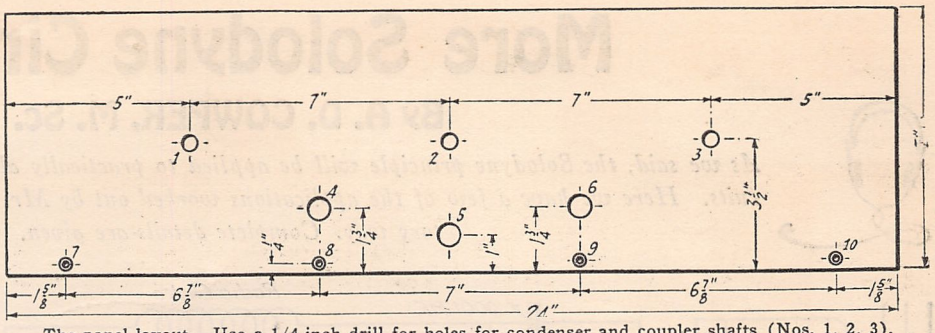


Constructional details and measurements of the radio frequency coupler. The coils on the outside tube are the primary and secondary windings of the tuned radio frequency transformer. The coil wound on the rotor is the tickler coil which is connected in the plate circuit of the detector vacuum tube. This coil provides regeneration.

is not available, use a large size drill. Mount the coupler midway between the two condensers using the same care in drilling the holes. The filament switch should be mounted below the coupler and the two jacks placed on the same level, but between the condensers and coupler. This panel layout is very pleasing to the eye and at the same time makes the parts easily accessible to connect. Four holes should be made ⅜ inch from the bottom of the panel and countersunk to provide for the mounting screws.

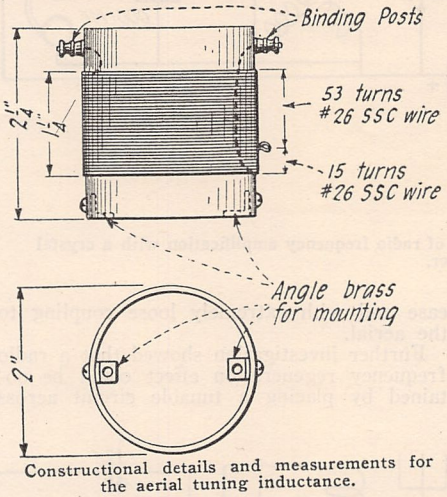
After the panel is fitted to the baseboard, disconnect it, as most of the wiring is done on the baseboard. The filament circuit should be wired first as the leads run close to the baseboard. All Amperites are connected in the negative lead. The Amperites specified are designed for UV-201A tubes or for any other five-volt tubes using ¼ of an ampere to light the filament. If other tubes are to be used, secure Amperites with the proper resistance. If a UV-200 or another soft tube is used as a detector, a rheostat will be necessary owing to the fact that a soft tube needs a critical filament control. It will be noticed, in the second push-pull tube, that the negative filament current is passed through the Amperite and connected to the positive binding post of the socket and the positive lead connected to the negative binding post of the socket. As polarity makes no difference as long as the filament is heated, the socket was connected with the filament current reversed to simplify the wiring. Following the completion of the filament wiring, continue with all the other wiring which can be made without the panel, being careful to solder all joints well unless they are screwed on, because one loose wire will cause a lot of trouble, for in case of a short-circuit, it may mean the purchase of six new tubes. In case one wire is very near another and is liable to touch, the best plan is to cover one wire for about one inch with some cambric covering. To keep the covering from sliding along the bus bar, either put a little cement under it or melt a small amount of lead on the wire and slide the covering over the bump.

When the jacks are soldered use the flux very sparingly or, better still, none at all. While on the subject of soldering, it is advised that resin flux be used. Otherwise it will be necessary to go over each joint with a cloth and alcohol to eliminate the possibility of corroded joints. A good grade of resin-core solder is the best to use. There are also a few brands of good, non-corrosive flux on the market.



The panel layout. Use a 1/4-inch drill for holes for condenser and coupler shafts (Nos. 1, 2, 3). Use a 7/16-inch drill for holes Nos. 4, 5 and 6 and a 1/8-inch drill and 1/4-inch countersink for holes Nos. 7, 8, 9 and 10. All measurements are given.

In mounting the variable condensers be sure to connect the variable plates to the filament or lowest potential point, and the stationary plates to the grid or tuning coil, which is at a higher potential, in order to avoid hand capacity effects.



Constructional details and measurements for the aerial tuning inductance.

After completing the wiring, go over it and, if possible, get someone to check it with you. When you think it is O.K., hook up the batteries carefully, and insert a tube in the radio frequency socket and another in the detector socket, the first and second from the left. Don a head set and plug into the left-hand jack. Turn the two condenser dials to the left, which will give maximum wave-length and turn the coupler dial to the right to secure maximum regeneration. Slowly turn the two condenser dials to the right until something is heard. Decrease the regeneration by turning the coupling dial to the right until the reception is clear and the regeneration below the oscillation point. If signals are received, put in the amplifier bulbs and plug into the second jack using the loud speaker, and if it is working, attach the loud speaker on the two binding posts in the rear for maximum volume. The automatic filament control jacks care for the bulbs so only those that are being used, remain lighted. As there is only one dial reading for each station it will be best to log the readings for future reference.

In case the set does not work and it is wired according to the diagram, try to find a loose or broken connection. Do not be too gentle when looking for a loose connection because resin without solder or too little of it will make a firm but poor electrical joint.

While on the subject of broken connections it might be well to test the various coil windings for a broken connection by putting a battery and buzzer or voltmeter in series with the winding in question. If the buzzer does not work or the voltmeter fails to register, look for trouble. If some particular tube does not light, try it in another socket and if it lights there change the amperite in the circuit because sometimes the resistance wire

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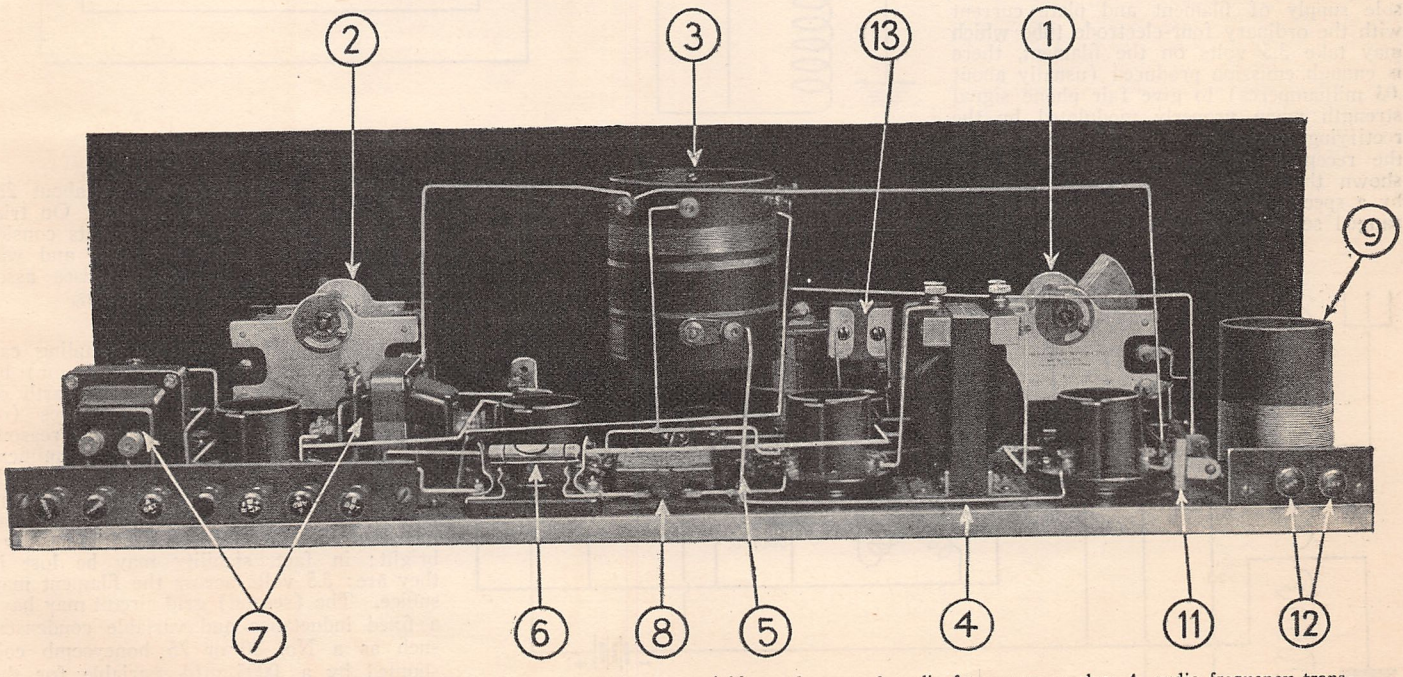


A rear view of the assembled receiver showing: 1 and 2, .0005 mfd. variable condensers; 3, radio frequency coupler; 4, audio frequency transformer; 5, 48,000-ohm resistance unit; 6, grid leak; 7, push-pull transformers; 8, by-pass condenser; 9, aerial tuning inductance; 11, grid condenser and leak; 12, aerial and ground binding posts; 13, by-pass condenser.

More Solodyne Circuits

By A. D. COWPER, M. Sc.

As we said, the Solodyne principle will be applied to practically all forms of present day circuits. Here we have a few of the applications worked out by Mr. Cowper in a most satisfactory way. Complete details are given.

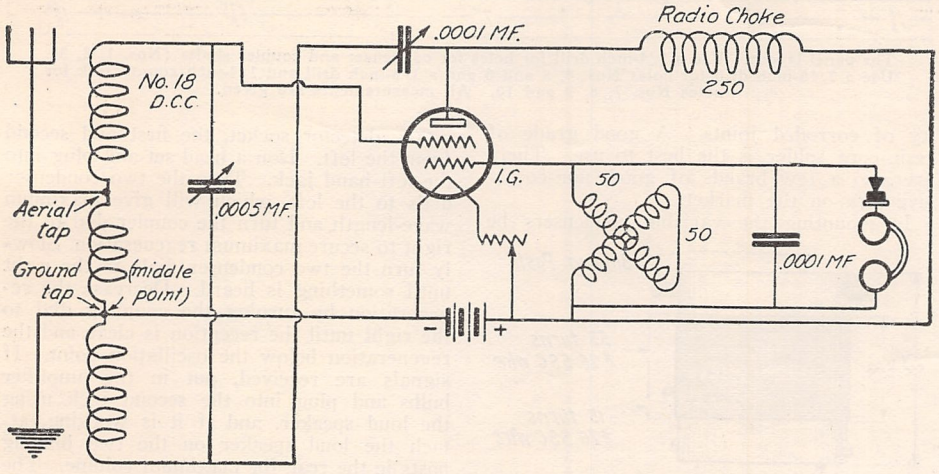


Fig. 1 A Solodyne circuit consisting of one stage of radio frequency amplification with a crystal detector.

A MODIFICATION of the four-electrode-tube circuit in common use by the Dutch amateurs for reception with extremely low values of plate voltage has been shown by the writer and others to be applicable to the extreme case in which the "B" voltage applied is provided by the potential drop in the filament resistance, when a six-volt "A" battery is used with a four-volt tube with the resistance in the positive lead. The fourth electrode—an inner, second grid—is given a positive charge by connecting it to the positive side of the battery. By partly neutralizing the effect of the space-charge, a moderate filament emission is allowed without a powerful "B" battery to overcome the resistance of the space charge to the flow of electrons.

CIRCUIT I

Even with a four-volt "A" battery as sole supply of filament and plate current with the ordinary four-electrode tube which may take 3.5 volts on the filament, there is enough emission produced (usually about .03 milliamperes) to give fair phone signal strength when properly modulated by the rectifying action of the grid condenser in the reception of signals. The writer has shown that good results can be obtained by a special transmitter type of circuit arranged so as to oscillate with the greatest ease and with extremely loose coupling to the aerial.

Further investigation showed that a radio frequency regeneration effect could be obtained by placing a tunable circuit across the same second grid and positive of the "A" battery, as in Fig. 1. The circuit oscillated even more easily than before, so that considerably less electrostatic feed-back was required from the plate. In fact, at times the filament had to be slightly dimmed in order to hold the circuit down with the minimum capacity of a low-minimum .0001 mfd. feed-back condenser in use.

An obvious step is then to put a crystal rectifying circuit across this second tuned grid circuit—which corresponds in a way to an ordinary tuned plate—resulting in circuit I. This was found to be quite effective, and gave appreciable radio frequency amplification. Actually the tuned circuit was a variometer of 50-50 turns of No. 22 D.C.C. wire, wooden ball rotor and 3¼-inch tube stator with a fixed .0001 mfd. condenser across it. With a good galena crystal it was pleasant to work, and (given a low-minimum in the feed-back condenser) sufficiently stable. The primary tuning arrangements were as previously described—of extremely low resistance and low damping.

CIRCUIT II

Following in the footsteps of the Marconi four-electrode circuit we get the reflex circuit II. The galena crystal comes next to the (second) grid; the outside secondary is nearly always connected to the first grid, through a radio-choke, as shown. The

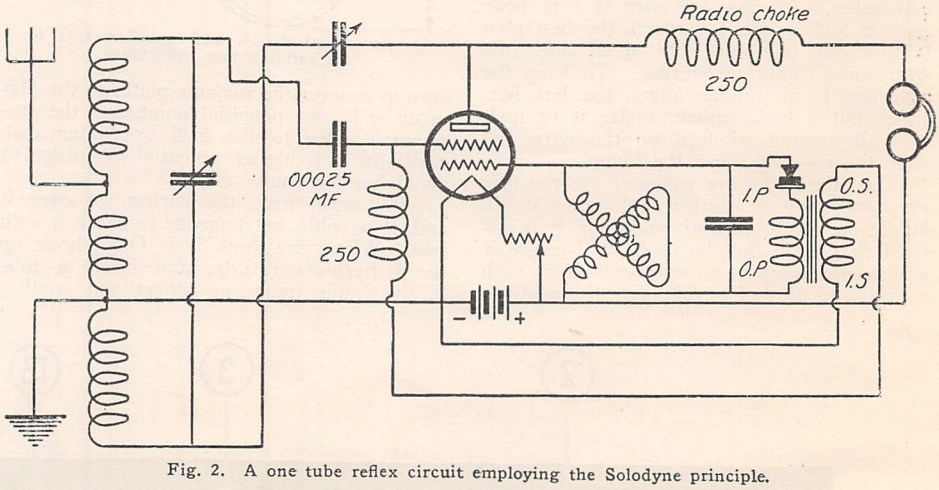


Fig. 2. A one tube reflex circuit employing the Solodyne principle.

choke is the customary coil of about 250 turns of low distributed capacity. On trial this circuit gave quite good results considering the small power available, and was almost free from unpleasant noises associated with powerful reflex circuits.

CIRCUIT III

The same radio frequency coupling can be applied to a second tube (detector) by substituting a grid condenser and earth or filament lead for crystal and phones (or transformer). Used in this way, a reasonable measure of radio frequency amplification results; and with a low-minimum feed-back condenser on the first tube, the circuit is stable and tunes sharply. The filaments of the tubes do not need to be very bright; in fact, stability may be lost if they are; 3.5 volts across the filament may suffice. The (second) grid circuit may have a fixed inductance and variable condenser, such as a No. 50 or 75 honeycomb coil shunted by a .0005 mfd. variable for the broadcast range—but better results will be obtained by using low-resistance coils and little tuning capacity across them.

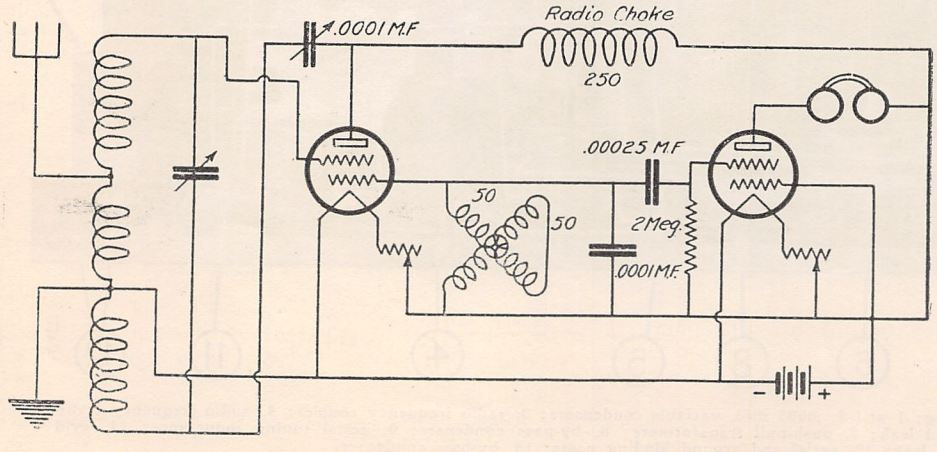


Fig. 3. A two tube circuit consisting of one stage of radio frequency amplification and detector.

CIRCUIT IV

Circuit IV is a detector-amplifier circuit, the phones of the simple detector circuit being substituted by an ordinary audio frequency transformer which is connected across grid and "earth" of a second four-electrode tube. The effect of small grid-bias (1-2 volts) should be tried. Good audio amplification was obtained this way, on trial but, of course, there is the limiting factor of the small plate-current (.03 milliamperes only). With a six-volt "A" battery, providing, say, 2.5 volts "B" battery the signal-strength was greatly improved, and with one or two flashlight batteries as "B" voltage quite good loud speaker work was possible.

A THREE-TUBE CIRCUIT

By combining circuits III and IV the more ambitious experimenter can achieve a three-tube circuit which will operate on a single four-volt "A" battery. But the limiting effect of the small plate-current in the last tube will be very evident, except on the most distant stations.

CIRCUIT V

A four-electrode tube Armstrong "flivver" circuit has been worked out with very encouraging results by Mr. D. F. Stedman, with a reasonable "B" voltage supply. A different type is shown in circuit V, which will actually operate without external "B" voltage on a four-volt "A" battery. This has been developed in principle, for use with standard tubes recently by the writer and gives excellent results with ordinary values of "B" battery. In this case, as the available power is so small, the coupling between the honeycomb coils must be rather looser than usual—say at 2-inch centers—and a D.L. 1,500 tickler coil is used, with a D.L. 1,000 oscillator coil bridged by a .01 mfd. fixed condenser. The latter coil also acts as radio-choke for the radio frequency feed-back. The circuit should be tried first with no radio frequency feed-back and honeycomb coils closely coupled, when a steady faint whistle should be heard; second, with the honeycomb coils well apart, e.g., swung at right angles, and with the feed-back condenser at maximum, receiving a wavemeter transmission. Then the coils should be swung up and separated again until the whistle is just on the point of disappearing, when, on cautiously increasing the feed-back from minimum, the great increase of signals (in the continued presence of the whistle) due to super-regeneration should be obtained. Final small adjustments may improve these. The filament does not need to be very bright. No details are given for the centrally tapped loop aerial, as these vary so much. One might try, for example, 25 turns of No. 22 on a two-foot frame, spaced ¼ in., for the broadcast range. Many more than the usual number of turns are needed in this mode of connecting and tuning the aerial. The tuning capacity must be kept small.

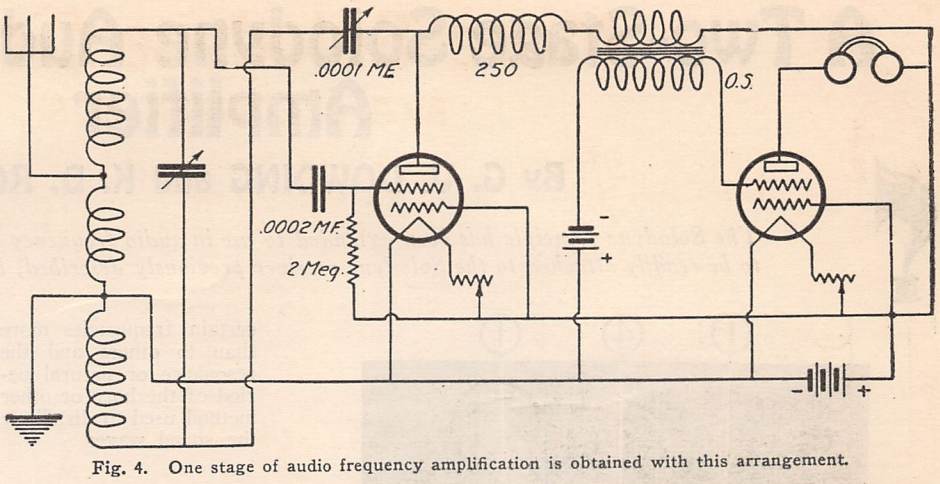


Fig. 4. One stage of audio frequency amplification is obtained with this arrangement.

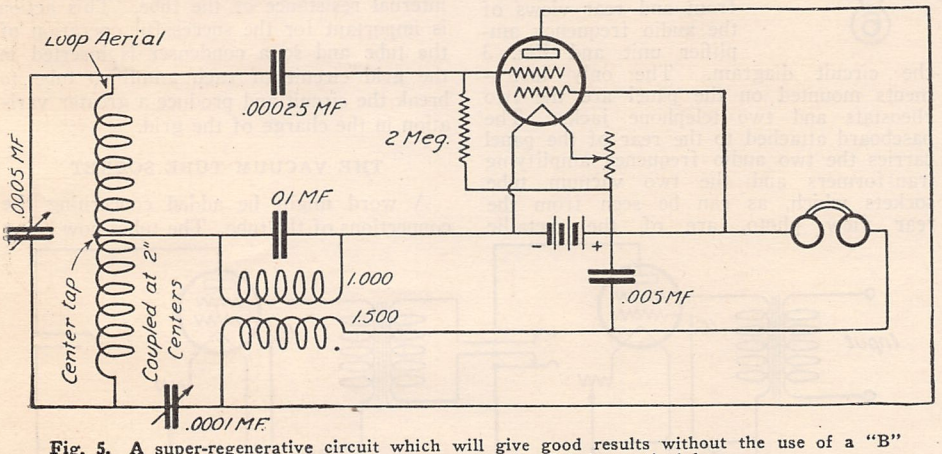


Fig. 5. A super-regenerative circuit which will give good results without the use of a "B" battery, working of course, on the Solodyne principle.

A TRANSMITTING CIRCUIT

It might be noted that a single-tube detector circuit of the type indicated (Circuit IV, left-hand part) if the secondary of a modulation step-up transformer is introduced into the second (inner) grid-circuit, and in series with the primary, microphone is inserted (also in series with the four-volt "A" battery), will act as an effective telephony transmitting circuit over very short distances, e.g., between neighboring aerials. A suitable transformer is a three- or six-volt bell-ringing transformer. The modulation leaves something to be desired. (It should be remembered that a transmitting license is necessary for even such low-power transmission as this set would develop.

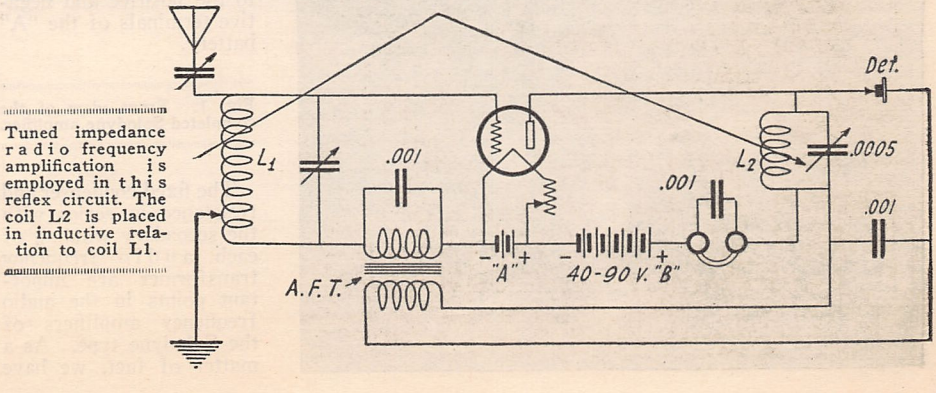
An Inexpensive, But Efficient Reflex Receiver

By E. G. BRUNDAGE

IN building this set I was guided by necessity, hence the simplicity, but in spite of this the results are a revelation. I receive WGR with sufficient volume to satisfactorily operate a loud speaker, and WGY and the other Eastern stations are heard very loudly and clearly. The clarity and purity are the salient advantages of the set. Its selectivity is somewhat superior to a single circuit regenerative, and I am bothered but little by interference. Having only two tuning controls, it is decidedly simple to operate, the crystal being the only troublesome part. So much for the efficiency.

In the hook-up it will be seen that tuned impedance radio frequency amplification is used and it is admirably suited for the purpose. I have had better results with the single circuit tuner, being simpler to operate, less expensive and giving greater volume, than with the double circuit type. The loss in selectivity is made up by the tuned radio frequency amplification, and regeneration, accomplished by using the secondary of a variocoupler as the antenna inductance, and the primary as the tuned impedance, thus providing regeneration by inductive feed-back. Satisfactory results could be obtained by using two plain coils, such as a D.L.-50 for the plate impedance and the antenna coil according to the antenna in use. The low inductance secondary is somewhat too small for my 80-foot antenna. The variable condenser across the antenna coil is a standard 33-plate one placed in parallel because of the low inductance of the secondary. The one across the plate impedance is a 23-plate condenser which I assembled myself. The reflex set described here is a remodeled regenerative type. The only new apparatus is the transformer with a 3½ to 1 ratio, and the smaller variable condenser.

(*Continued on page* 405)



Tuned impedance radio frequency amplification is employed in this reflex circuit. The coil L2 is placed in inductive relation to coil L1.

A Two-Stage Solodyne Audio Frequency Amplifier

By G. V. DOWDING and K. D. ROGERS

The Solodyne principle has been extended to use in audio frequency amplifiers. It is so built as to be readily attached to the Solodyne receiver previously described, but is adaptable to any set.

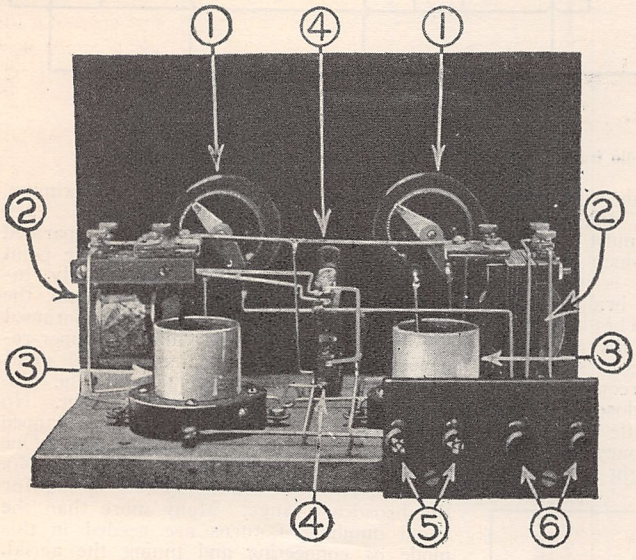


Fig. 2. Rear view of the Solodyne amplifier. No. 1 shows the rheostats; 2, the A.F. transformers; 3, the sockets; 4, the jacks; 5, the "A" battery binding posts; and 6, the input binding posts.

HAVING described the theory and construction of a one tube regenerative Solodyne receiver, the next step is to give details of a two stage audio frequency amplifier operating on the Solodyne principle, which can be conveniently attached to the Solodyne receiver. The two stage audio frequency amplifier described here is of efficient form and may be connected to the detector unit to form a very compact receiver—one that can be used for loud speaker reception within a reasonable range of a broadcast station.

DISTORTIONLESS AMPLIFICATION

While discussing loud speaker reception it will be noticed by all who make this unit that the usual rushing, hoarse noises often emanating from the loud speaker when attached to the usual form of receiver employing a "B" battery, are absent. When no speech or music is coming through, there is a background of absolute silence. The speech and music are very clear and distinct and most of the throatiness usual in loud speaker reproduction is eliminated.

This does not mean there is absolute freedom from distortion, for wherever there are audio frequency amplifiers and loud speakers, as we now know them, there is sure to be a risk of distortion on account of the responsiveness of the transformer to certain frequencies more than to others and the resonance or natural period of the horn or other method used to distribute the sound waves.

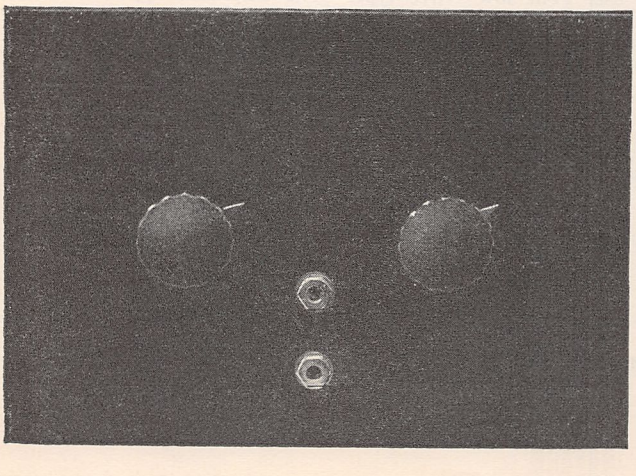


Fig. 1. Front view of the completed Solodyne amplifier.

PLACING OF THE INSTRUMENTS

Figs. 1 and 2 show the front and rear views of the audio frequency amplifier unit and Fig. 3 the circuit diagram. The only instruments mounted on the panel are the two rheostats and two telephone jacks. The baseboard attached to the rear of the panel carries the two audio frequency amplifying transformers and the two vacuum tube sockets which, as can be seen from the rear view photo, are of the metallic shell type. On the rear, at the left, is a small strip of bakelite which supports the four necessary binding posts employed for making the external connections. The two to the left are the input binding posts and connect directly to the primary winding of the first audio frequency amplifying transformer. The two others connect to the positive and negative terminals of the "A" battery.

The fixed condenser and resistance in series with the secondary winding of each audio frequency transformer are important points in the audio frequency amplifiers of the Solodyne type. As a matter of fact, we have been unable to obtain any really satisfactory amplification when the transformers were connected in the conventional way, that is to say, to the grid of the tube and to either of the terminals of the "A" battery. There is no doubt signals can be obtained with the conventional method, but amplification by this connection will be many times less than that obtained with the leak and condenser method.

Apropos the condensers, it is obvious, if the two grids are connected together near the "A" battery that there will be a fairly steep potential slope between the two grids, because the inner grid is at full positive potential while the control grid is at nearly the full negative. This results in greatly nullifying the effect of the inner grid, thus unsetting the balance of the circuit, raising the internal resistance of the tube.

The inner grid is placed there expressly for the purpose of overcoming the high internal resistance of the tube. This action is important for the successful operation of the tube and so a condenser is inserted in the grid circuit of each amplifier tube to break the circuit and produce a greater variation in the charge of the grid.

THE VACUUM TUBE SOCKET

A word might be added concerning the connections of the tube. The tubes now being sold for the Solodyne receivers have the outside or control grid connected to the shell.

As there are two grids, care must be taken to see that they are properly connected, for if the grids are reversed by some mistake in connections no results will be obtained.

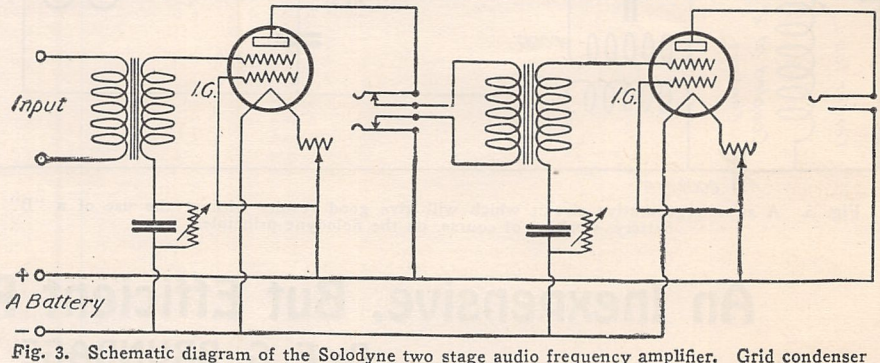


Fig. 3. Schematic diagram of the Solodyne two stage audio frequency amplifier. Grid condenser and leaks are required in the grid circuits.

POINTERS

Another point about this amplifier is the provision of variable resistances across the condensers in the grid circuits so the best results possible can be obtained. The actual values of the resistance cannot be stated, as they vary with the individual transformers and tubes. Generally, a variable grid leak will be suitable for the purpose. If this resistance is too high, a thin pencil line across the .001 mfd. condensers will serve efficiently. The two audio frequency transformers employed in this amplifier should have a ratio of approximately 4½ to 1.

Constructors should remember to connect the inside grid, marked I.G. in Fig. 3 to the regular binding post on the socket and the control grid to the metal shell of the socket.

(*Continued on page* 414)

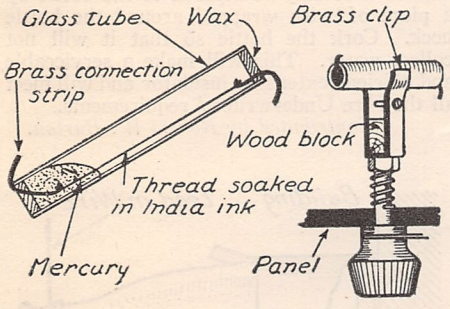
Awards of the $50 Radio Wrinkle Contest

First Prize

A MERCURY VARIABLE GRID LEAK

By L. W. ELLIOTT

An excellent variable grid leak may be made with a piece of glass tube about 2 inches long. A heavy thread is soaked in India ink and run through the glass tube close to the inside wall. This thread is held at one end by a short piece of brass or copper strip. The other end is embedded in a piece of sealing wax which entirely closes one end of the tube. Another brass strip is also inserted in this end of the tube so that it will make contact with a quantity of mercury which is placed in the



Details of a mercury variable grid leak.

tube. This mercury should be of such bulk that it will almost completely cover the thread when the tube is placed in a horizontal position. After the right quantity of mercury has been found, the other end of the tube should also be sealed with wax. This variable leak is mounted in a brass clip, which is attached to a knob and shaft inserted through the panel. A small block of wood is bolted to one end of the shaft and the brass clip is held in place over it, as shown in the diagram. A stiff brass spring is placed over the shaft between the panel and the wooden block so that sufficient tension is always had to keep the grid leak in any position in which it may be placed. Light, flexible leads may be soldered to the two brass connection strips at either end of the tube. When the tube is in a vertical position maximum resistance is had and as it is gradually turned to the horizontal position, the mercury short circuits more of the thread, thus cutting down the resistance.

Second Prize

A DEVICE TO FASTEN ENDS OF NARROW COILS

By WILLIAM C. ROEMER

In winding coils for various purposes, it is frequently necessary to place a winding having but few turns over another winding, the turns of which cover a considerable width. When such a case presents itself, the problem is to provide a suitable anchorage for the beginning and end of the smaller coil.

The usual method is to fasten the wire to the form outside of the winding already in place and make a turn with a large spiral to the point where the second coil is to be wound. At the end of the winding the process is reversed. This method does not make a neat job and unless shellac or some form of "dope" is used, there is a pronounced tendency for the end coils to loosen.

The sketch herewith shows a quick, neat, simple and substantial method of fastening the ends of narrow coils when such coils are wound centrally or otherwise over wider coils. All this requires is two small pieces

Prize Winners

First Prize $25

A MERCURY VARIABLE GRID LEAK

By L. W. ELLIOTT
9639—105th Street,
Edmonton, Alta. Canada.

Second Prize $15

A DEVICE TO FASTEN ENDS OF NARROW COILS

By WILLIAM C. ROEMER
656 Winthrop Ave.,
New Haven, Conn.

Third Prize $10

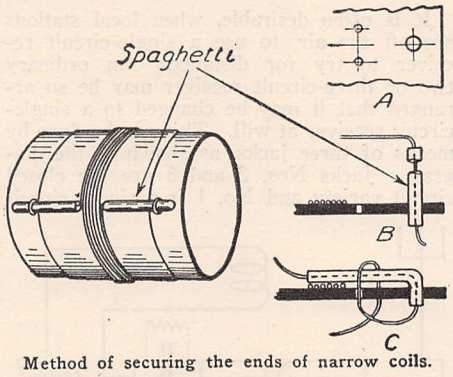
NON-CORROSIVE BATTERY LEADS

By A. P. PECK
32 Park Place,
Plainfield, N. J.

of fairly stiff spaghetti. The work proceeds as follows:

Drill three holes in the form opposite the beginning and end of the winding. Sketch A shows one group of holes. The larger hole should fit the outside diameter of the spaghetti and the smaller ones should be large enough to permit the size of wire used for the coil to pass through several times.

Cut two pieces of spaghetti to suitable length draw the wire to be used for winding the coil through one piece of spaghetti and insert it in the large hole, as shown by B.



Method of securing the ends of narrow coils.

Bend the spaghetti over, as shown by C, and thread the free end of the wire through the small holes, forming one or more loops around the spaghetti as shown.

Wind the required number of turns on the coil. Hold the last coil with one hand, cut the wire, draw the end of the winding through the second piece of spaghetti and repeat the foregoing operations.

Third Prize

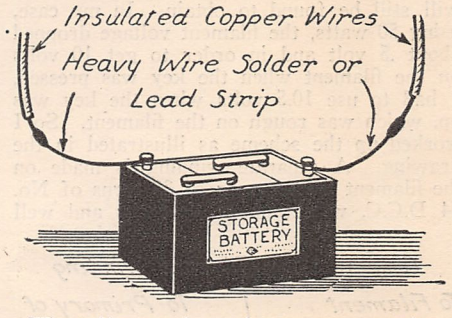
NON-CORROSIVE BATTERY LEADS

By A. P. PECK

The fumes that arise from a lead plate storage battery when it is charging or discharging have a very troublesome property of corroding certain metals. One of the metals so affected is copper. Usually leads made of this material are used for connecting the storage "A" battery to the set. In such a case the wires soon start to corrode, especially at the point where they are fastened to the battery terminals. This corrosion takes the form of a soft pasty, bluish mass, being most prominent at one terminal.

After this formation starts to build up, the connection between the wire and the battery terminal becomes bad and gives trouble. Usually it is necessary to entirely remove the wire and thoroughly clean the terminal.

All of this trouble can be remedied once and for all by soldering or clamping a piece of heavy, hard wire solder about a foot long to each of the terminals. The copper leads may then be soldered to the ends of the lead strips, as shown. Other materials than solder may be used for this purpose. Strips of lead, or in fact any lead that can be readily found and can be soldered or clamped



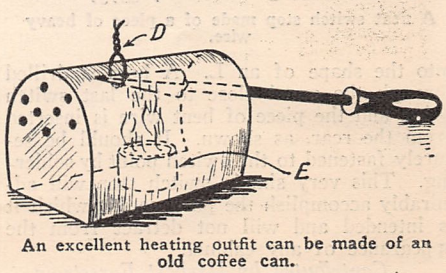
Wire solder may be used to prevent corrosion on battery connections.

tightly to the terminals will fill the bill. The most important point is to keep the copper leads away from the battery, using the non-corrosive metal where it will be exposed to the fumes arising from the battery.

As an added precaution, coat the connections, the terminals of the battery and the connection strips with a thin film of vaseline or lubricating grease. This will prevent any possible corrosion of any impurities that happen to be present in the metals, and will tend to preserve the appearance of the battery.

A COFFEE CAN SOLDERING OUTFIT

The following suggestion is made for the benefit of those who, like myself, do not care to invest a couple of dollars in an electric soldering iron. It works like a charm and will take any soldering iron from the ten-cent store variety up. This soldering outfit is made as follows: A coffee can should be obtained which has been put together without solder. By means of a pair of tin snips or a heavy pair of shears, a strip is removed from the can about 2½ inches wide. The closed end of the can should have 8 or 10 holes punched in it. Two holes are also punched in the top of the can and a piece of wire inserted in the form of a loop shown in the drawing as D. The heating element may consist of an ordinary can of solidified alcohol, but it is advisable to make a small alcohol stove for this purpose. A small can such as is used for canned heat is obtained and is packed full with cotton batting. A disk of wire screen or netting is then forced under the rim of the can. The cotton bat-



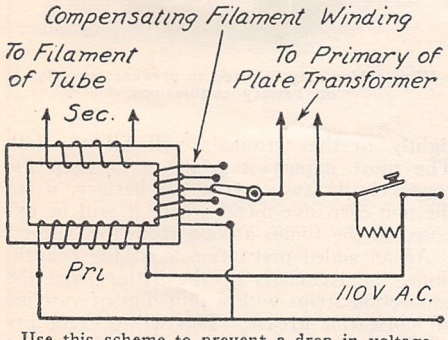
An excellent heating outfit can be made of an old coffee can.

ting should be soaked with alcohol and will burn without danger. This is placed inside the coffee can, as shown at E in the sketch; the soldering iron is inserted in the wire loop and the alcohol lighted. It will take very little time to bring the temperature of the iron to the proper point. When sufficiently hot, the blaze may be partly covered by a tin cover.

Contributed by Chas. E. Gage.

KEEPING THE FILAMENT VOLTAGE CONSTANT IN THE C.W. TRANSMITTER

Most amateurs who use C.W. transmitters of 50 watts or more find there is a drop in voltage on the sending tube filament every time the key is closed. Even though a separate filament transformer is employed this will still be found to obtain. In my case, using 50 watts, the filament voltage dropped about .5 volt and in order to get 10 volts on the filament when the key was pressed, I had to use 10.5 volts when the key was up, which was rough on the filament. So I worked up the scheme as illustrated in the drawing. A separate winding is made on the filament transformer of 30 turns of No. 14 D.C.C. wire tapped five turns and well



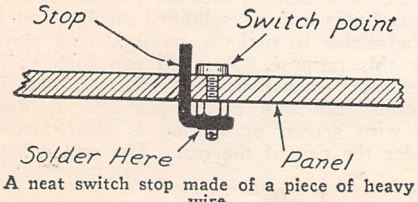
Use this scheme to prevent a drop in voltage on the filament when transmitting.

insulated from the core and other windings. The taps are brought out to a multi-point switch and this is connected in series with the primary of the plate transformer. Adjust the switch, starting with five turns, so when the key is pressed the filament voltage remains constant. It may be necessary to reverse the connections on this extra winding. It will be found that greater efficiency and a higher radiation will be obtained with this plan in effect.

Contributed by V. E. Thomas.

A NEAT SWITCH STOP

In building a receiver wherein a switch stop is required, it will not be necessary to purchase one, as the following scheme may be used. This stop consists of a piece of No. 14 bare copper wire or bus-bar bent



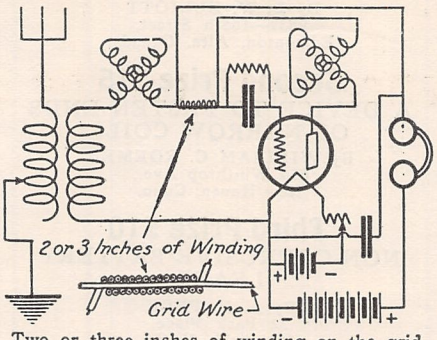
A neat switch stop made of a piece of heavy wire.

into the shape of an L. A hole is drilled through the panel close to the last switch point, and the piece of bent wire is inserted from the rear, as shown. It should be securely fastened to the switch point by soldering. This very simple switch stop will admirably accomplish the purpose for which it is intended and will not detract from the appearance of any cabinet.

Contributed by Herbert Forsstrom.

A SIMPLE WAVE-LENGTH INCREASE METHOD

Many times a broadcast listener has a receiver with variometer tuned plate and grid circuits. The wave-length range of most of these sets is about 150 to 420 meters. This range was all right until some of the better stations increased their wave-lengths. Now a broadcast receiver should cover from 250 to 550 meters. A very low value condenser connected from the grid to the plate will



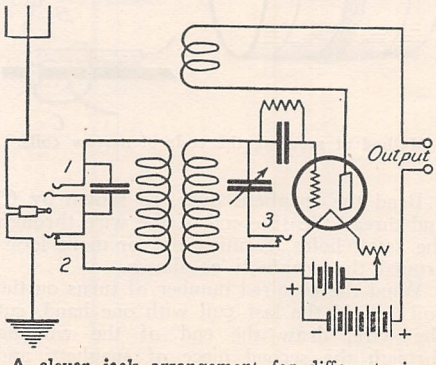
Two or three inches of winding on the grid wire will increase the wave-length.

increase the wave-length of both the plate and grid circuits, but will usually prevent the control of oscillation by the plate variometer. The above diagram shows a very simple method whereby the wave-length may be increased and at the same time creating no interference with the control of regeneration. It seems that the reactance of the turns offset the bad effect of the straight capacity between the grid and plate wires. This is a handy stunt to use in different places where it is desired to increase wave-length.

Contributed by Frank T. Parrish.

COMBINATION SINGLE AND DOUBLE CIRCUIT RECEIVER

It is often desirable, when local stations are off the air, to use a single-circuit receiver to try for distance. An ordinary two or three-circuit receiver may be so arranged that it may be changed to a single-circuit receiver at will. This can be done by means of three jacks, as shown in the diagram. Jacks Nos. 2 and 3 are the closed circuit variety and No. 1 is a single circuit



A clever jack arrangement for different circuits.

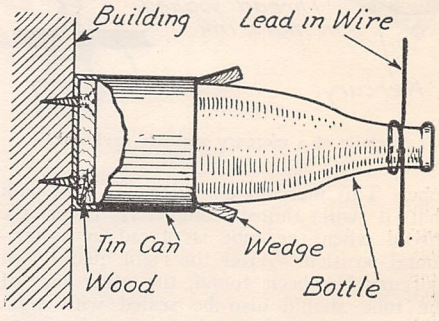
one. The antenna and ground are connected directly to a plug through separate leads. A telephone cord should never be used for this purpose as the capacity of the two parallel wires is sufficient to raise the wave-length of the primary circuit considerably. When the plug is inserted in jack No. 1, the variable condenser in the primary circuit is in parallel with the coil and when inserted in jack No. 2 the condenser is in series with the coil. When a single-circuit receiver is desired, the plug should be inserted in jack No. 3, and the tuning is then done by the variable condenser, which was originally in parallel with the secondary winding.

Contributed by A. W. Tervo.

AN EFFICIENT "STAND-OFF" INSULATOR

Although the Fire Underwriters' regulations specify that all lead-in and ground wires should be supported at least five inches from the wall of any building, it is almost impossible to obtain an insulator designed for this purpose. A very efficient substitute may be made from an old ginger ale bottle and a tin can. The bottle should fit snugly inside the can. The can should be nailed or screwed to the outside of the building where the insulator is to be placed. In order to hold the can firmly, and to prevent its pulling away from the wall, it might be best to place a piece of wood, cut to the correct size, inside the can and nail or screw directly through it. The bottle should be inserted in the can and if it does not fit snugly, several small wooden wedges may be forced between it and the can to make it more secure. The lead-in wire may be secured to the bottle by a piece of wire wrapped around the bottle neck. Cork the bottle so that it will not collect water. This will make a serviceable and efficient extension insulator and will meet all the Fire Underwriters' requirements.

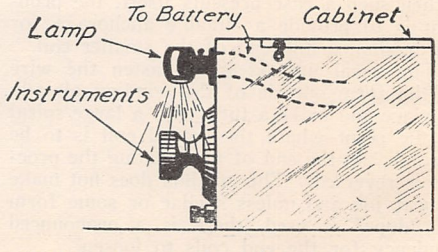
Contributed by Robert W. Burton.



A tin can and a bottle makes a fine "stand-off" insulator.

A NIGHT LIGHT FOR THE RECEIVER

It very often happens that just the night you wish to stay up late and pull in DX stations, you have been commanded by the powers that be to keep the electric light bill as low as possible and to be in bed at a respectable hour. On occasions such as this, it invariably happens that these nights are the best for long distance reception. Therefore, if you wish to operate your receiver, it would be advisable to employ a night light such as is described below. This simply consists of a nickel-plated lamp such as is used on the instrument board of an automobile. These lamps sell for about 35 or 50 cents and may be obtained at practically any automobile supply store. It should be mounted on the panel of the receiver, directly above the main tuning dials, as shown in the sketch and the two supply wires should be connected directly to the "A" battery line in series with the filament switch. The upkeep



Method of using lamp for night reception with portable sets.

of this light will be very small and it can be switched off or on when desired.

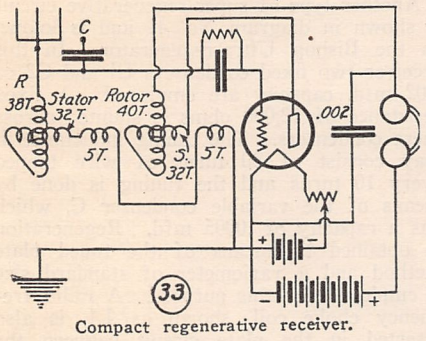
Contributed by John J. Strayer.

STANDARD HOOK-UPS

EVERY month we present here standard hook-ups which the Editors have tried out and which are known to give excellent results. This leaf has perforation marks on the left-hand margin and can be cut from the magazine and kept for further reference. These sheets can also be procured from us at the cost of 5c to pay for mailing charges.

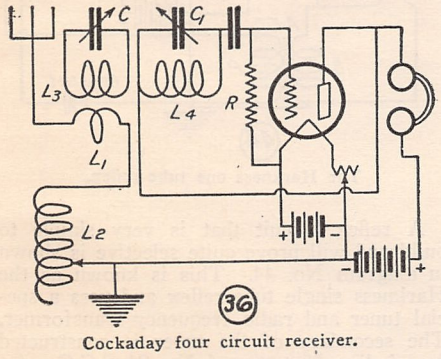
RADIO NEWS has also prepared a handsome heavy cardboard binder in to which these sheets may be fastened. This binder will be sent to any address, prepaid on receipt of 20c. In time there will be enough sheets to make a good-sized volume containing all important hook-ups. Every year an alphabetical index will be published enumerating and classifying the various hook-ups.

Handy Reference Data for the Experimenter



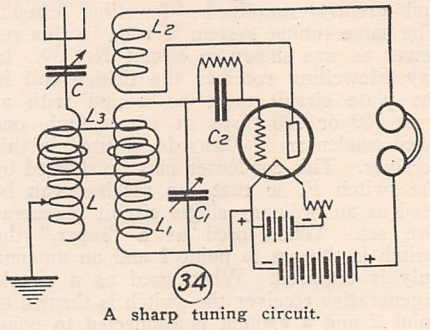
Compact regenerative receiver.

In diagram No. 33 is shown a circuit which will prove very efficient, being selective and sensitive and at the same time very compact. This type of receiver may readily be used as a portable set. It really consists of two variometers, the stators of which are both wound upon the same form separated from each other 1¾ inches. The stator winding of the plate variometer is continued for five turns on each side of the stator winding of the plate variometer as shown. This gives a combination of tuned plate and tickler feed-back. The proper number of turns for both variometers is shown on the diagram. It will be advisable to place a fixed condenser (C) of .0005 mfd. in the antenna circuit and provide two binding posts so that the antenna may be connected directly to the variometer or through the condenser as desired.



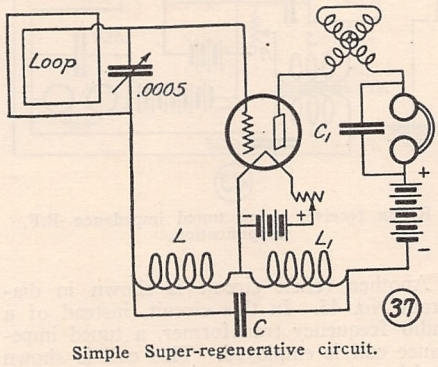
Cockaday four circuit receiver.

Diagram No. 36 shows the well-known Cockaday circuit, which has proven very popular. The antenna system is comprised of coils L1 and L2. L1 is a single turn of bus-bar wire around coil L3. L2 consists of 43 turns of No. 18 S.C.C. wire on a 3-inch tube. This coil is double bank wound and may be tapped every six turns. It is also in non-inductive relation to the other coils. L3 consists of 34 turns of No. 18 S.C.C. wire and is also wound on a 3-inch tube. L4 consists of 65 turns of the same size wire and is wound on the same tube, with L3, separated from it by about ⅛ inch. Variable condensers C and C1 have a capacity of approximately .003 mfd. and are of the 17-plate variety. Most of the tuning is done with condenser C1 and regeneration or oscillation is controlled by condenser C.



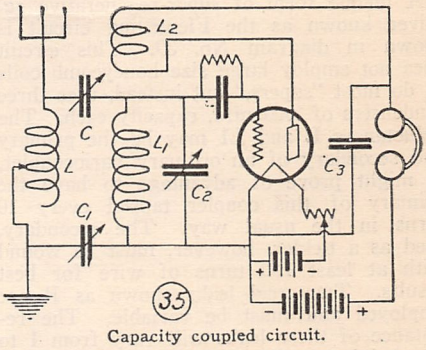
A sharp tuning circuit.

In circuit No. 34 we have a receiver which will prove very selective, especially in a district where many broadcast stations are located. The condenser C may be of .00025 mfd. capacity, but may be left out if desired, as it is not absolutely necessary. L may be a coil of 80 turns tapped at every 10 turns, L1 and L2 are the primary and secondary of a variocoupler. In this case, the primary of the coupler should consist of about 35 turns of wire. L is not in inductive relation to L1 but is coupled thereto by means of a continuous loop of wire shown at L3. This loop should be wound three turns around each coil, as shown in the diagram. Most tuning will be done with the condenser C1, which in this case may be of .0005 mfd. The grid condenser C2 is of standard size (.00025 mfd.).



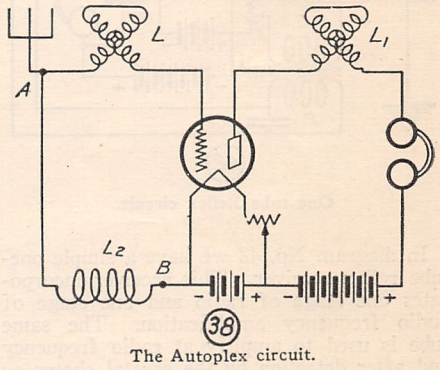
Simple Super-regenerative circuit.

Diagram No. 37 shows a super-regenerative receiver which, if correctly constructed and operated, will give remarkable results on all stations received. A loop is used for this type of receiver and is tuned by a variable condenser of .0005 mfd. capacity. Coil L is a honeycomb or duo-lateral coil of 1,500 turns and coil L1 is one of 1,250 turns. These coils are shunted by a fixed condenser C of .004 mfd. capacity. A standard variometer is inserted in the plate circuit, which will control the regeneration. A fixed condenser C1 is also shown connected across the phones, but it may sometimes be dispensed with, with no loss in efficiency. When receiving, there will always be in evidence a high pitched whistle known as the variation frequency. If this whistle is too bothersome it may be reduced by decreasing the size of the condenser C.



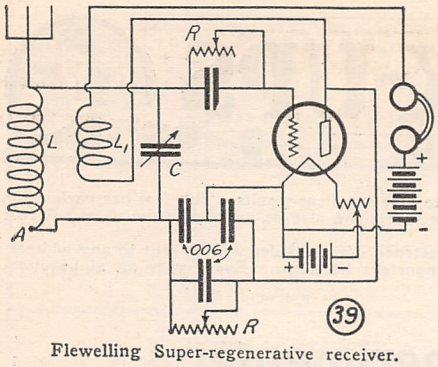
Capacity coupled circuit.

Circuit No. 35. In this diagram we have a circuit using capacity coupling. This coupling is accomplished by means of condensers C and C1, which are of .0005 mfd. capacity. The main tuning inductance L is, as usual, of about 80 turns, which may be tapped at every 10 or 12 turns. Coils L1 and L2 may be the primary and secondary of a standard variocoupler. It will not be necessary to use taps on the primary of this coupler, as a fixed number of turns (approximately 35) will be sufficient when tuned by the .0005 mfd. variable condenser C2. The coil L2 is inserted in the plate circuit of the detector for regeneration. The bypass condenser C3 is of .001 mfd. This receiver, although a trifle difficult to tune will prove very selective and distant stations may be heard while locals are on the air.



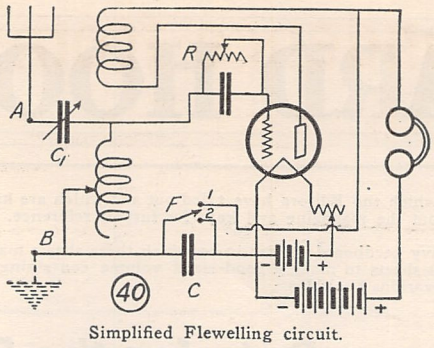
The Autoplex circuit.

Diagram No. 38 shows a simplified and improved super-regenerative circuit known as the Autoplex. In this circuit two variometers shown as L and L1 are employed to tune the grid and plate circuits. These variometers must be of good manufacture and should have a large value of inductance. Only one honeycomb coil of 1,250 turns shown at L2 is used in this receiver. This receiver will give very good results with an antenna or ground alone, connected to point A. If a ground is to be used with the antenna, it should be connected to point B. As a rule best results are obtained with an antenna of about 50 feet in length. For loud speaker results, a good amplifying tube such as a UV-201A or a WE-216A should be employed. The "B" battery can be anywhere from 45 to 150 volts.



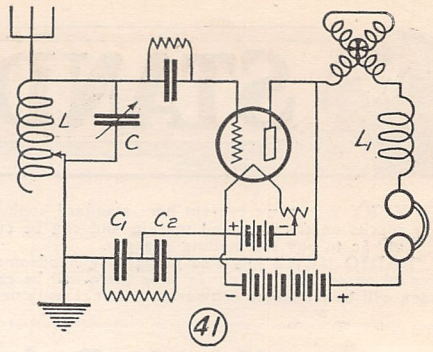
Flewelling Super-regenerative receiver.

A unique form of super-regenerative receiver known as the Flewelling circuit is shown in diagram No. 39. This circuit does not employ large size honeycomb coils as do most "supers," but instead, uses three condensers of .006 mfd. capacity each. The inductances L and L1 may be the primary and secondary of an ordinary variocoupler. It might prove of advantage to have the primary of this coupler tapped every 10 turns in the usual way. The secondary, used as a tickler, however, must be wound with at least 100 turns of wire for best results. Two grid leaks shown as R are employed and must be variable. The resistance of these leaks will vary from 1 to 10 megohms. The variable condenser C, which is used for tuning, has a capacity of .0005 mfd. (23 plates). The "B" battery in this receiver must be fairly large and can be of any voltage from 90 to 150. A hard or amplifying tube must be used in this receiver if best results are to be obtained. A ground is not shown in the diagram, as it is usually not necessary, but one may be tried at the point shown as A.



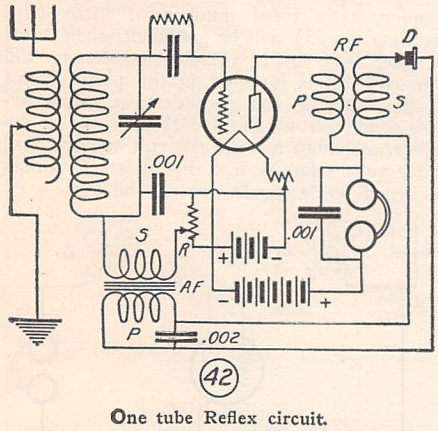
Simplified Flewelling circuit.

In diagram No. 40 is shown a modified and greatly simplified Flewelling circuit. The same tuning system is used in this receiver as was shown in circuit No. 39. In any Flewelling receiver the tickler coil in the plate circuit must be wound with at least 100 or 120 turns of wire. Only one fixed condenser of .006 mfd. is used in this receiver. This condenser may be shorted by the switch F, so that the receiver can be used as an ordinary single circuit regenerative set. When used as a "super," the switch is thrown to point 1 and an antenna only is required. When used as a simple regenerative receiver the switch is thrown to point 2 and a ground is connected to point B, as shown by the dotted lines. The variable condenser C1 may have 17 or 23 plates, but the smaller size is recommended. The grid leak R is variable and has a resistance of from 1 to 10 megohms. When this receiver is operating correctly as a super-regenerative set, local stations will be strong enough to operate a loud speaker. When used as an ordinary regenerative receiver, the phones will have to be used for all stations.



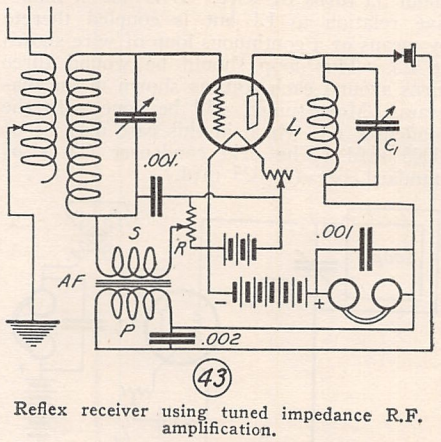
The Bishop Ultra-regenerator.

Another type of super-regenerative circuit is shown in diagram No. 41 and is known as the Bishop Ultra-regenerator. In this receiver two fixed condensers C1 and C2 of .002 mfd. capacity are employed. A fixed resistance of 12,000 ohms is shunted across these condensers. The tuning inductance L may consist of 80 turns of wire tapped every 10 turns and the tuning is done by means of the variable condenser C, which has a capacity of .0005 mfd. Regeneration is obtained by means of the tuned plate method and a variometer of standard size is employed for this purpose. A radio frequency choke coil, shown as L1, is also inserted in the plate circuit between the variometer and the phones and consists of a honeycomb or duo-lateral coil of 400 turns. A fixed grid leak is shown in the circuit, but it is always advisable to use a variable grid leak of from 1 to about 10 megohms. This type of receiver functions best when a tube having large elements, such as UV-201-A, is used. A storage battery of six volts will be required for the filament of such a tube and a rheostat of 15 or 20 ohms should also be employed.



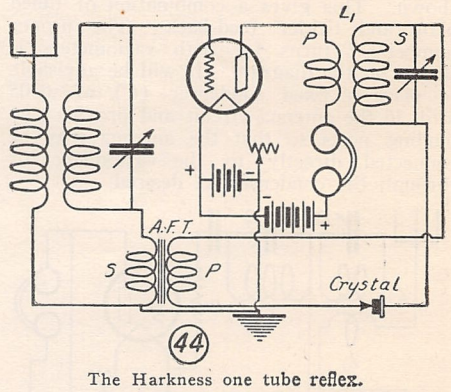
One tube Reflex circuit.

In diagram No. 42 we have a simple one-tube reflex receiver. This receiver incorporates one stage of radio and one stage of audio frequency amplification. The same tube is used to amplify at radio frequency and after detection by the crystal shown as D, it again amplifies at audio frequency. An ordinary variocoupler may be used for tuning and the secondary is shunted by a variable condenser of .0005 mfd. capacity. A potentiometer shown as R is used so that the tube may be kept from oscillating. This instrument should be of rather high resistance; in the neighborhood of 400 ohms. It will be noticed that fixed condensers are connected across the phones and the primary and secondary of the audio frequency transformers. These condensers are known as by-pass condensers and are employed to allow the radio frequency currents to pass the high resistance of the phones and the coils of the audio frequency transformer. The capacities shown on the diagram for these condensers are only approximate and it may be necessary to experiment with different sizes for best results.



Reflex receiver using tuned impedance R.F. amplification.

Another reflex circuit is shown in diagram No. 43. In this circuit, instead of a radio frequency transformer, a tuned impedance coil is employed. This coil is shown as L1 and may consist of a 50-turn honeycomb coil, or may be made by winding 45 turns of No. 24 S.C.C. wire on a 3-inch tube. A variable condenser C1 of .0005 mfd. capacity is shunted across this impedance coil for tuning. Any type of tuner may be used, although in this case a standard variocoupler is shown, the secondary of which is tuned by a 23-plate variable condenser. A 400-ohm potentiometer shown as R is employed to keep the tube in a stable operating condition. This type of reflex receiver will be found much more selective than that shown in diagram No. 42. The tuning condenser across the secondary of the coupler and the variable condenser across the tuned impedance coil must both be tuned to exactly the same wave-length before any station can be received. If the tube tends to oscillate, the potentiometer lever should be moved towards the positive side to correct this condition.



The Harkness one tube reflex.

A reflex circuit that is very simple to build and will prove quite selective is shown in diagram No. 44. This is known as the Harkness single tube reflex and uses a special tuner and radio frequency transformer. The secondary of the tuner is constructed by winding 55 turns of No. 24 S.C.C. wire on a 3-inch tube. The primary is of 15 turns, wound directly over the secondary and separated from it by a piece of insulating paper. The secondary of this coupler is shunted by a variable condenser of 17 plates. The special radio frequency transformer shown as L1 is made in a similar fashion. The secondary is wound the same as the special coupler, but the primary consists of 20 turns of wire. The secondary of this transformer is also shunted by a 17-plate condenser. A fixed crystal detector is ordinarily used in this receiver, although any good crystal detector may be employed. This receiver operates very satisfactorily without the use of any by-pass condensers that are commonly needed in other reflex circuits. When tuning this receiver, both variable condensers must be tuned at the same time and must be in resonance for any station.

Correspondence from Readers

TO THE RADIO SUPERVISORS

Editor, RADIO NEWS:

'Smatter? Is the Radio Supervisor for the Atlantic Coast sick, on a vacation or what is wrong here of late?

Heard him at a recent Philadelphia banquet throwing bouquets at himself in regard to the absence of interference by code. Said the ships had promised to be good, practically no amateurs misbehaving, etc., and I will say that he was justified in his remarks *then.* For about three months conditions were fairly good, but *now! whoee!* They've cut loose again, not only the naval stations (which we have with us always) and commercial stations also, but the ships and even the amateurs.

Being able to read code, I am not guessing, but know it is the amateurs, thanking George for the book or asking when he is coming over. It certainly was annoying, when listening to the Convention at Cleveland, to have a ship keep interfering at the interesting times. Certainly when that operator stopped sending he could also hear the talking at the Convention, and must have known he was bothering thousands of listeners.

The Radio Supervisor said he had many complaints, but they were too general in character and not specific as a rule, but when they were specific and he ran them down (at great trouble and expense) they were usually unjustified.

Here, however, is a suggestion for him. Of course, I know it is easy to tell someone else how to run his business, but if I were a Radio Supervisor I would have some postal cards printed with blank spaces to be filled in and when I listened I would fill the card and send it at once to the offending party. The printed polite request for consideration of others would, I think, show the operator that someone was on the job and he would be more careful thereafter.

The big movement by the Broadcasters Association to have this interference eliminated seems to have died a slow but sure death. Personally, I think the Supervisor, with the aid of a few postals, could stop most of it. Certainly most men are reasonable and upon receipt of a card will more than likely desist; if not, another card with "Second Notice" written upon it, and then a phone call or letter.

I wish the supervisor would state in your columns his idea as to the practicability of the above suggested method.

PETER MORRELL,
Wilmington, Del.

A BOOSTER FOR RADIO NEWS

Editor, RADIO NEWS:

I am a reader of your magazine, and my interest in it has grown up with it. I can remember the day when only one newsstand in the city in which I lived handled your magazine and they only got a few copies and there was always a mad rush for them. I kept for some time the first copy I bought, but somehow I have lost track of it. I save them for reference, and find them better than any technical books on the market.

In this connection I wish to agree with all M. A. P. Roux said in the last issue regarding the brains of the radio dealers. I think there ought to be a law against anyone selling radio parts until he or she has passed a simple radio examination. Many times I have gone into a store and have asked what was best for this or that and then listened to a line of radio terms that even I could see were senseless. They usually say you need a good many things or the circuit will not work well when in reality they have put in everything they sell that will not injure the circuit. Of course, they will say that is good business. It has given me much pleasure the past few years to go into a store and ask the advice of some of these promising young radio advisors and when they have finished I feel like saying "You had better try that one out yourself," and they will look at you in a surprised way and like a "dumb-dora" ask, "Why?" Ask for the manager and nine cases out of ten he is always out to lunch. He will listen to your troubles and then draw out a circuit and hand it to you and say: "Try this," just like a doctor. Many of these have just come to the front in radio in the past year or so, during the broadcasting rage, and they have spent a lot of money trying to find out which circuit is the best, and finally are successful in making one of them work. They will then advise everyone that a circuit unlike theirs would be of no value and that they had better get one or they will be out of style. I was steered wrong this way once and never again. Next time I want any information I will write RADIO NEWS.

N. V. LEACH,
Box 748,
Needles, Calif.

40 Non-Technical Radio Articles

every month for the beginner, the layman and those who like radio from the non-technical side.

SCIENCE & INVENTION, which can be bought at any newsstand, contains the largest and most interesting section of radio articles of any non-radio magazine in existence.

Plenty of "How To Make It" radio articles and plenty of simplified hook-ups for the layman and experimenter. The radio section of SCIENCE & INVENTION is so good that many RADIO NEWS readers buy it solely for this feature alone.

List of Radio Articles Appearing in the September Issue of "Science and Invention"

A Super-Neutrodyne With Four Stages of Tuned R. F.—Details of the set that rolls 'em in from coast to coast.
Story of a Kiss by Radio.
Broadcast Stations We Have Seen.
How Radio "Drammer" is Produced.
World-Wide Radio Broadcasts Received on Telegraph Circuit Without Radio Apparatus.
Radio Oracle—Questions and Answers.
Radio Wrinkles.

QUITE RIGHT

Editor, RADIO NEWS:

While I possess neither a technical training, nor education, I can fully appreciate the requirements necessary to make an engineer, and a diploma is only the beginning.

There are countless numbers of men today who think they are fully justified in writing "Radio Engineer" after their names, while, as a matter of fact, even though they do possess a considerable knowledge of radio, they should be content with the word "Radiotrician," for that is all they are entitled to.

My remarks are prompted by Mr. Pyle's article in the June issue of RADIO NEWS, "Are you a Radio Engineer," which I think is very opportune.

H. M MATTHEWS,
3534 Olive Street,
St. Louis, Mo.

TRY THIS ON YOUR SET

Editor, RADIO NEWS:

Now that static interference is in full swing and sometimes takes the entire joy out of reception, perhaps a slight alteration in a set will make a great improvement and give good reception, at least on the phones, even though the loud speaker is not likely to be of use.

My set is regenerative, so I do not know whether the same results will be obtained with other hook-ups, but I added a switch blade and two points to the panel. One switch point connects with the negative of the detector "B" battery, the other point connects with the lowest voltage point on the battery and the switch blade is connected to the wire removed from the negative of the "B" battery. Assuming the various terminals on the "B" battery are connected to switch points already, the addition of the two-point switch merely makes a convenient method of reducing the plate voltage on the detector tube, one point giving a range on the other switch from 16½ to 22½ volts, and the other point gives a range from 1½ to 7½ volts.

Just previous to a storm in which crash after crash of static came in with the plate voltage at 18, it was impossible to get satisfactory reception even on the detector alone. With the voltage reduced to 7½, the static was nearly silenced and music and speech came in clearly. However, it took two stages of audio frequency with the phones, and the volume was about equal or slightly less than is ordinarily had with one stage of audio. I am of the opinion that a third stage of audio would have given very good results on the loud talker.

I cannot account for the reduction in the plate voltage decreasing the volume of static so much more than it did the music, but that is what happened. At first the static came in much louder than the music, but with reduced voltage, the volume of music was as loud as is desirable in the phones and the static was just barely perceptible.

WM. HOFMANN,
916 Madison Ave.,
Kewanee, Ill.

[*We experienced the same phenomenon while using a Solodyne ("B" battery-less) set. It seems to reduce static very considerably.—Editor.*]

REGARDS A SEA-GOING "OP"

Editor, RADIO NEWS:

I too have suffered some disappointment by reason of the recent omission of "With the Sea Going Ops" from your valuable publication, and was somewhat surprised at the reason you gave for it, in the June issue. I was under the impression that you more than had your hands full with letters sent by commercial operators for publication in that section. Although in the past I have often felt I would like to write you a letter, I have always refrained from doing so as I have always been given to understand that all editors were ultra-severe critics, and therefore figured my efforts could not possibly escape the proverbial waste basket. However, in your comment on the letters of inquiry, sent by Mr. W. C. Ellsworth and Mr. Thomas Nugent, you have shown that it is as much my fault as the fault of anyone else that the department in question ceased to be. I am, therefore, taking a chance, a long chance, so if you do not consider it worth putting into print, please acknowledge in your paper as follows: "KDVJ r qsb qru sk"; that will not take up much space,

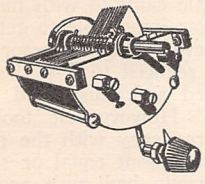
(*Continued on page* 350)

RADIO manufacturers are invited to send to RADIO NEWS LABORATORIES, samples of their products for test. It does not matter whether or not they advertise in RADIO NEWS, the RADIO NEWS LABORATORIES being an independent organization, with the improvement of radio apparatus as its aim. If, after being tested, the instruments submitted prove to be built according to modern radio engineering practice, they will each be awarded a certificate of merit, and a "write-up" such as those given below will appear in this department of RADIO NEWS. If the apparatus does not pass the Laboratories tests, it will be returned to the manufacturers with suggestions for improvements. No "write-ups" sent by manufacturers are published on these pages, and only apparatus which has been tested by the Laboratories and found to be of good mechanical and electrical construction is described. Inasmuch as the service of the RADIO NEWS LABORATORIES is free to all manufacturers whether they are advertisers or not, it is necessary that all goods to be tested be forwarded prepaid, otherwise they cannot be accepted by the Laboratories. Address all communications and all parcels to RADIO NEWS LABORATORIES, 53 Park Place, New York City.

Apparatus Awarded Certificates

CONTINENTAL "LO LOSS" CONDENSER

The Continental "Lo Loss" straight line condenser is one of the grounded rotor type and is furnished with a vernier attachment, as shown in the illustration. The losses at 1,000 cycles are equivalent



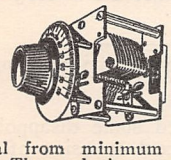
to a series resistance of 125 ohms. The maximum capacity is 492.70 mmf. and the minimum, 10.98 mmf. This condenser is manufactured by Gardiner & Heyburn, Inc., Philadelphia, Pa.

Arrived in excellent packing.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 506.

NATIONAL DX CONDENSER

The National DX vernier condenser is of the grounded rotor type and has low dielectric losses. These losses at 1,000 cycles are equivalent to a series resistance of 80 ohms. The maximum capacity is 507.34 mmf., and the minimum, 14.64 mmf. A reducing gear arrangement of 5 to 1 ratio is incorporated within the knob and dial so that 2½ turns of the knob turns



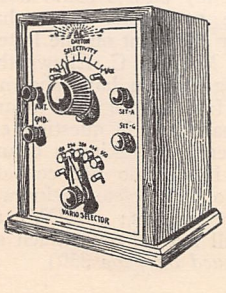
the dial from minimum to maximum. The reducing arrangement is very compact and has practically no backlash. This condenser is manufactured by the National Co., Inc., 110 Brookline St., Cambridge, P. O. Boston, Mass.

Arrived in excellent packing.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 502.

COPP VARIO SELECTOR

The Copp vario selector is not a wave trap. It is an instrument designed for use with single circuit



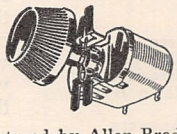
receivers and converts them into double circuit receivers. It consists of a tapped antenna or primary coil and a rotor coil of a few turns of wire inductively coupled to the antenna coil. The rotor coil connects to the antenna and ground binding posts of the single circuit receiver. With its use the single circuit receiver is made very selective. Manufactured by the A-C Electrical Mfg. Co., Dayton, Ohio.

Arrived in excellent packing.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 490.

BRADLEYOHMS

The Bradleyohm is a carbon disk pressure type of rheostat designed to cover various ranges of resistances. The No. 25 Bradleyohm is rated at 25,000 to 250,000 ohms. Under actual test it more than covered this range. They will be found useful in many circuits, such as in resistance coupled amplifiers.



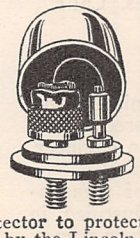
Manufactured by Allen-Bradley Co., Milwaukee, Wis.

Arrived in excellent packing.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 486.

LINCOLN DETECTOR

The Lincoln enclosed semi-permanent detector is designed for front of panel mounting and is compact. The catwhisker and the detector cup fit in metal sockets in the holder case and are easily moved about for adjustment. Once adjusted, the detector holds its adjustment for a long time and a nickel finished cup fits over the



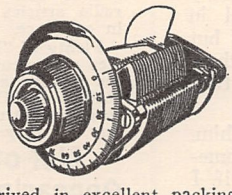
entire detector to protect it. Manufactured by the Lincoln Radio Co., 115 East 11th Street, Los Angeles, Calif.

Arrived in excellent packing.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 488.

SOUTHWORTH VARIABLE CONDENSERS

The Southworth 14, 24 and 26 plate vernier type variable condensers were submitted by the Southworth Specialty Co., 91 Seventh Ave., New York City. These condensers are of the usual construction and are furnished complete with knob and dial. The dielectric absorption losses at 1,000 cycles are equivalent to series resistances of 670, 360 and 55 ohms respectively. The maximum capacities are 255.19, 459.15 and 1032.6 mmf. respectively. The minimum capacities are 12.20, 14.03 and 15.25 mmf.

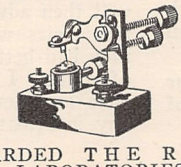


Arrived in excellent packing.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATES OF MERIT NOS. 503, 504 and 505.

AMBROSE VERNIER DETECTOR

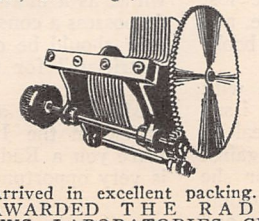
The Ambrose crystal detector is of accurate mechancal construction and highly finished. It has three adjustment knobs: One attached to the detector cup changes the position of the crystal; another controls the catwhisker adjustment; and the third acts as a vernier adjustment on the catwhisker. With this arrangement a very light and sensitive contact on the crystal is easily obtained. Manufactured by the Ambrose Radio Co., 220 Vernon Ave., Brooklyn, N. Y.



AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 487.

AIRPHONE LOW LOSS CONDENSER

This condenser, as the illustration shows, has a geared vernier attachment having a 7 to 1 reduction ratio. It is of the grounded rotor type. The dielectric absorption losses at 1,000 cycles are equivalent to a series resistance of 110 ohms. The maximum capacity is 436.58 mmf. and the minimum, 14.03 mmf. Manufactured by A. W. Bowman & Co., 23 Church Street, Cambridge, Mass.

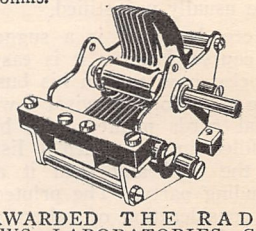


Arrived in excellent packing.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 501.

HARKNESS CONDENSER

The Harkness condenser differs from the usual type in that the complete sets of rotor and stator plates are die cast, each in one piece. The condenser is of the grounded rotor type and has very low losses. The 15-plate condenser submitted by the Radio Guild, Inc., 256 West 34th Street, New York City, has a minimum capacity of 10.37 mmf. and a maximum capacity of 371.92 mmf. The dielectric absorption losses at 1,000 cycles are equivalent to a series resistance of 40 ohms.



AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 476.

ROLLER-SMITH D.C. VOLT METER

This voltmeter, Type TD, is made especially for radio use. It has a six-volt scale for indicating the filament voltage and a 120-volt scale for indicating the plate voltage of the vacuum tubes. It is the flush mounting type, 3½ inches in diameter over all. The voltmeter readings are very accurate. Manufactured by the Roller-Smith Co., 233 Broadway, New York City.

Arrived in excellent packing.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 491.

BILTRITE BATTERY HYDROMETER

In order to determine whether a storage battery is in good condition the specific gravity of the liquid in each cell should be measured. This requires an accurate hydrometer. The one shown in the illustration is manufactured by the Biltrite Motor Equipment Co., Inc., 822 10th Ave., New York City. This hydrometer is accurate in its readings and of durable construction. It will tell instantly if the battery is in a charged or discharged condition.

Arrived in excellent packing.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 493.

RHAMSTINE NEEDLEPHONE

The Rhamstine Needlephone will enable anyone who owns a phonograph to make use of the excellent acoustic qualities of the horn and tone arm in conjunction with a radio set. The Needlephone is simply plugged into the receiving set and the needle of the phonograph is set into the groove in the armature of the Needlephone. The armature is adjustable and vibrates in accordance with the electric impulses received

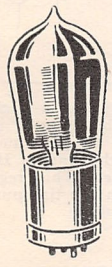
over the radio set. These vibrations are transmitted to the diaphragm of the phonograph where they are reproduced in the form of sound waves. It is not necessary to remove the sound chamber of the phonograph when using a Needlephone. This instrument is manufactured by J. Thos. Rhamstine of Detroit, Mich.

Arrived in excellent packing.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 499.

BIRK-MORTON TUBE

The type B-M 201-A vacuum tube manufactured by the Birk-Morton Vacuum Products Co., Owensboro, Ky., is of the standard construction and has a five-volt ¼ ampere filament and is designed for plate voltages up to 90. The char-

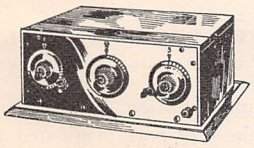


acteristics of this tube are up to standard and it gives very good results in actual operating conditions, both as amplifier and detector.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 495.

RADIODYNE RECEIVER

The type WC-11 Radiodyne receiver is manufactured by the Western Coil and Electric Co., Racine, Wis. Although this receiver employs six tubes, it is very compact in size, measuring only 7 x 21 x 7¼ inches high. It comprises two stages of tuned R.F. amplification, one stage of untuned R.F. amplification detector and two stages of A.F. amplification. The



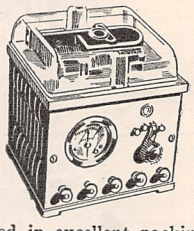
R.F. amplifiers are tuned by a combination of variometers and variable condensers. Only three dials are on the front of the panel for tuning purposes, as shown in the illustration. The filament rheostat and two other control dials which need little changing are mounted inside of the cabinet.

Arrived in excellent packing.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 496.

VALLEY BATTERY CHARGER

In order to charge a storage battery on the 110-volt A.C. lighting circuit, some sort of rectifier for converting the alternating into direct current must be used. The Valley battery charger is a mechanical rectifier. A vibrating reed which vibrates in syncronism with the frequency of the alternating current makes contact with heavy carbon brushes and rectifies the current. The charger also has a step down transformer that lowers the voltage to the proper value. By means of different taps the battery may be charged at various rates. This device is also equipped for charging storage "B" batteries. An ammeter on the charger indicates the current. The charger is manufactured by the Valley Electric Co., St. Louis, Mo.



Arrived in excellent packing.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 485.

STRAITLINE CONDENSERS

The 15, 23, and 43 plate Straitline variable condensers, manufactured by the Haig and Haig Mfg. Co., Rochester, N. Y., are of the grounded rotor type and are of very simple and durable construction. The losses in these condensers are exceptionally low. At a frequency of 1,000 cycles the dielectric absorption losses are equivalent to series resistances of 50, 40 and 55 ohms respectively. The maximum capacities are 332.88, 520.15 and 1001.4 mmf. The minimum capacities are 9.15, 12.81 and 20.74 mmf. respectively. The illustration shows the 43-plate condenser.

Arrived in excellent packing.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATES OF MERIT NOS. 507, 508 and 509.

DUAL LOUD SPEAKER

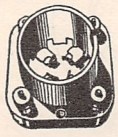
Besides being a very sensitive and well constructed loud speaker, this instrument also incorporates an ear phone attachment of the stethoscope type. By turning the lever from one position to the other, either the horn or the ear phone attachment is placed over the open-

ing in front of the diaphragm. The lever arm is also used for adjusting the distance between the pole tips and the diaphragm in the loud speaker unit. The ear phone attachment, of course, saves the expense of a telephone head set. Manufactured by the Dual Loud Speaker Co., 210 West 54th St., New York City.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 500.

MAZDA SOCKET

The Mazda standard vacuum tube socket is of the usual construction of molded bakelite, but is somewhat different than the ordinary in that it has double spring contacts.



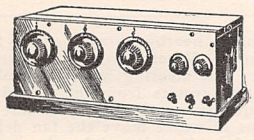
One spring makes contact with the tip of the vacuum tube prong and the other spring makes contact with the side of the prong. This arrangement insures excellent contact. Manufactured by the Mazda Radio Mfg. Co., 3405 Perkins Ave., Cleveland, Ohio.

Arrived in excellent packing.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 492.

POLYDYNE RECEIVER

The Polydyne five-tube receiver is a very attractive and highly finished instrument. The mahogany cabinet, on which is mounted an 8 x 27 inch panel, is 12 inches deep and 10 inches high. There is plenty of space inside of the cabinet for



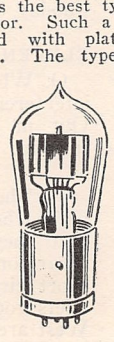
the "A" and "B" batteries. The set comprises two stages of tuned R.F. amplification, detector and two stages of A.F. amplification. The set is well balanced and does not oscillate. It is a very sensitive instrument and reproduces broadcast programs with excellent quality. Manufactured by Dietzen, Inc., New York City.

Arrived in excellent packing.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 497.

ROYALTRON TYPE 200 TUBE

A vacuum tube containing a small amount of gas is known as a soft tube, and is the best type for use as a detector. Such a tube must be operated with plate voltages under 22½. The type 200 tube



shown in the illustration, which is manufactured by the Royal Mfg. Co., 206 Broadway, New York City, is so constructed and is an exceptionally sensitive detector tube. It works well with a plate voltage of 16. The filament consumes a current of one ampere at five volts.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICTE OF MERIT NO. 494.

STROMBERG-CARLESON LOUD SPEAKER

The illustration shows the No. 1-A loud speaker manufactured by the Stromberg-Carleson Telephone Mfg. Co., Rochester, N. Y. The horn is of a rough and attractive finish, having a 12½-inch bell and standing 26½ inches high. The adjustable loud speaking unit is mounted in the mahogany base. The loud speaker is furnished complete with cord and plug. The unit responds with uniform volume over a wide band of frequencies and consequently the loud speaker reproduces with very little distortion.

Arrived in excellent packing.

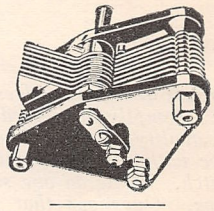
AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 498.

PAUSIN VARIABLE CONDENSER

This condenser is of simple construction and is very efficient electrically. It has 17 plates, a maximum capacity of 321.4 mmf., and a minimum capacity of 11.95 mmf. The condenser is of neat appearance and rugged construction. Manufactured by the Pausin Engineering Company, 727-739 Frelinghuysen Ave., Newark, N. J.

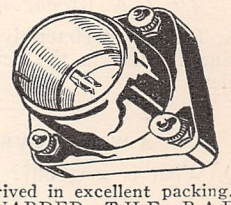
Arrived in excellent packing.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 384.



PORCELAIN SOCKET

The Hart & Hegeman Mfg. Co., of Hartford, Conn., has brought out an all-porcelain vacuum tube socket with "Sure Grip" contacts. The socket, type W-198, is finished in black and is of pleasing appearance. The tube is pushed directly into the socket without turning and the contacts clamp the sides of the tube prongs.



Arrived in excellent packing.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 489.

Coming Radio Expositions

THIRD ANNUAL NATIONAL RADIO SHOW

This year's big get-together of the radio world is scheduled for the week of October 2 to 8, when, at Grand Central Palace, New York, the American Radio Exposition Company will conduct the Third Annual National Radio Show.

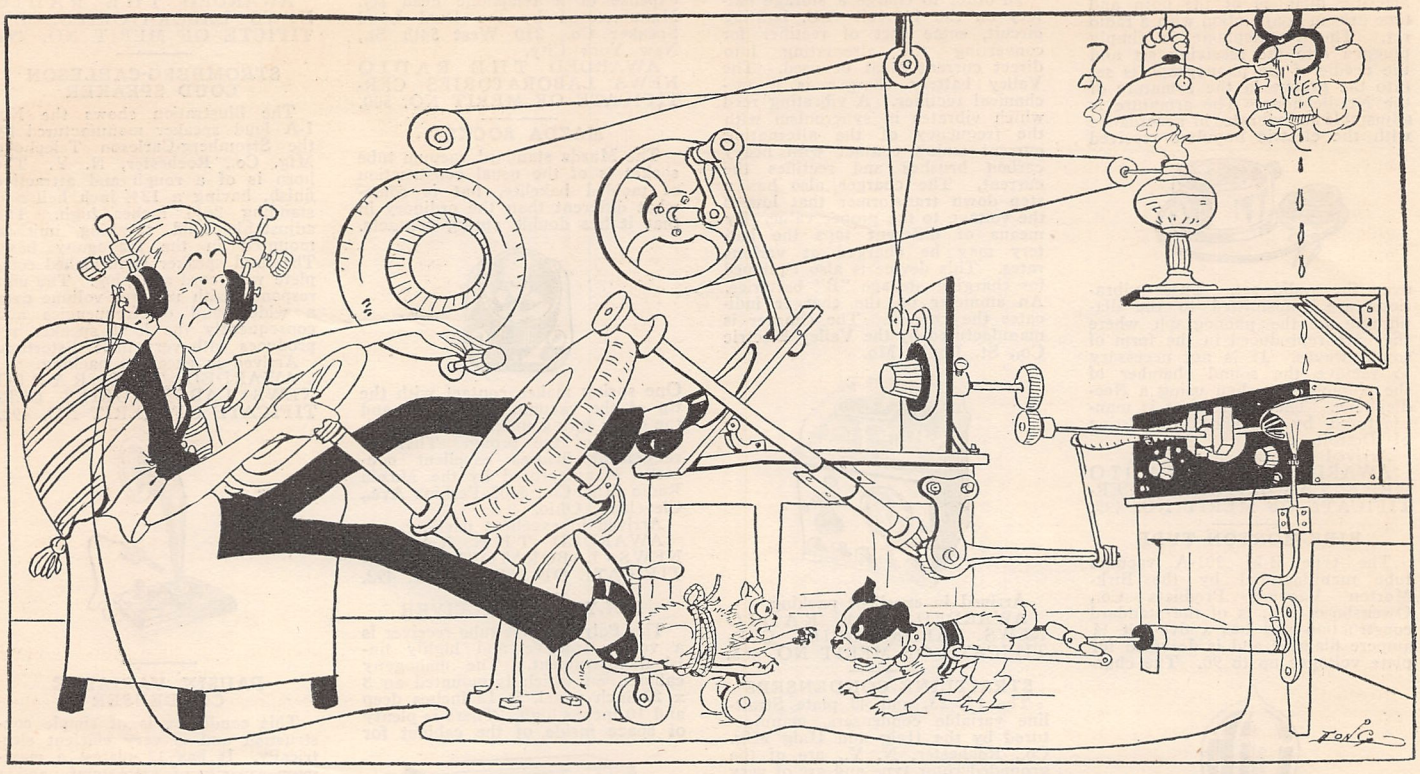
The company has leased the entire ground floor and mezzanine balcony of Grand Central Palace for the occasion. This assures more extensive exhibiting space and better facilities for handling the huge throngs of patrons than was the case last year when the event was held on the fourth floor of the exposition building. Already the general manager and his staff of assistants are laying the foundations for the most elaborate entertainment and exhibition program ever contemplated for the radio industry.

Approximately 100,000 persons attended last year's exposition and this year, with increased show space and greater facilities, that number will be doubled or tripled.

Exhibitors will be interested to learn that the profit-sharing plan put in force last year will be continued—the exhibitors to receive 50 per cent. of the net proceeds of the show to be divided among them in direct propor-

(*Continued on page* 423)

Radio Humor



With the aid of a few spare parts from a nearby garage, and a few borrowed tools, anyone, with a little engineering ingenuity and a hack-saw, can construct a very simple Micro-tuner. When carefully adjusted, this condenser control has produced remarkable results, bringing in distant stations in regular alphabetical order. The steering wheel control makes the coarse adjustment on the dial by means of the tiregear and left-handed monkey-wrench. A finer setting results from the step-down gearing from left-hand large dial, and vernier rod on the knob. Having reached the zero beat between the squeals, gently press the left foot working the crank control of the kerosene lamp flame. This regulates the heat that melts the ice. The drops of water move the fan delicately. The fan motion is reversed by the puffs of air from the tire pump as the dog moves back and forth, agitated by the cat on the kiddie car. Avoid boot-leg kiddie cars for best results.

Queer Queries and Ready Replies

By I. R. TANNEHILL

Useless questions addressed to this department promptly answered if written on a good quality of paper and mailed in an envelope with a small quantity of tobacco and a match. Write on one side of the paper at a time. Questions that floor the technical editor cheerfully solved here. Don't hesitate. Grab a handful of pencils and ask us something.

FLABBINESS OF THE BILL-HOLDER

Q. Does the use of the radio have any effect upon the heart or other vital circulatory organs?

Dr. J. K. Groan, Aching Joint, Md.

A. The Super-Heterodyne produces an annoying flatness in the neighborhood of the wallet.

A WIRE'S OVERCOAT

Q. What is spaghetti?

G. I. Manxious, Ohio.

A. Spaghetti is a varnished rag rolled into the shape of a snake's undershirt.

SPARK STATION Q.R.M.

Q. Every night, while listening in on the radio, I am bothered by my two daughters sitting out in the porch swing with a couple of dumbbells until after midnight. I have to send my wife out to call them in the house. Please advise.

B. Google, Spark Plug, Ky.

A. You are correct in using your loud speaker to bring in the Nighthawks.

OR TRY SISTER'S GARTERS

Q. I have all the apparatus necessary to install my radio except the insulators. I have no money left. What would you suggest?

Nine-Year-Old, Oklahoma.

A. Pry the rubber heels off your father's Sunday shoes.

ELEVEN SQUEAKS TO THE SQUARE INCH

Q. Why are there so many complaints of interference from regenerative receivers? Out in Helena we have very little such trouble.

Ardent Fan, Helena, Mont.

A. The complaints come from New York City where there are so many radio sets that they are obliged to place cardboard separators between the aerials to prevent short circuits. In the more congested districts good radio programs from the Middle West are frequently left standing in line for hours before they can find an empty antenna.

The only remedy for these squeaking noises is to keep the aerials well greased.

CONTAINS NOTHING BUT NOISE

Q. What is a vacuum?

Hopeless, California.

A. A vacuum in radio is an empty space surrounded by a vacant bulb.

HOOK-UP FOR A BREAD RECEIVER

Q. How is the diaphragm connected into the circuit?

Harry Neck, Barberton, Md.

A. The diaphragm is connected directly between the soup transformer and the hash condenser.

EVERYTHING BURNS BUT THE WIRE

Q. What is the best method of soldering a connection? Where can I learn to solder properly?

R. Berry, Seedville, Ark.

A. Hold the wire against the connecting post and the hot iron against the wire until a blister the size of a quarter forms on your left thumb. Remove the thumb while hot and allow the solder to cool. The thumb should always be well tinned before soldering with it.

A LOOP WILL DO JUST AS WELL

Q. How are choke coils used? Give me a hook-up.

Percey Scratch, Poison Ivy, Georgia.

A. The choke coil was originated by a Sheriff in Arizona. It is placed in shunt with the prisoner's neck and the trap sprung. See the Sheriff for this hook-up.

PULLS 'EM TOO FAR

Q. I have heard that the Super-Heterodyne is a very sensitive circuit. Please tell me how distant stations come in on this type of receiver.

Far-Away, Reno, Nev.

A. Stations 4,000 miles away or farther sound as if they are a few feet away. Stations at a distance less than 2,000 miles seem to be behind you.

COAL SHOVELER'S FROLIC

Q. Is there more than one variety of static?

James Bunion, Sorefoot, Ala.

A. There are eight types of static as follows:

1. The glass crasher.

2. The grinding tooth.
3. The growler.
4. The sky-rocket whizzer.
5. The back-firing Ford.
6. The seven-years' scratch.
7. The falling dish-pan.
8. The sneezer.

AND A.B.C.'S FOR CALL LETTERS

Q. How much education must a man have to become a radio engineer?

I. M. Spotted, Measles, La.

A. To be a radio engineer you must be able to write so you can make a pencil mark grid leak.

ETIQUETTE FOR DIAL-TWISTERS

Q. What is the proper manner in which to tune a radio receiver?

Henry Boils, Job, Idaho.

A. Dress in evening clothes. The hat is not worn while tuning, as the headset does not rest well when worn over the hat, especially if straw or derby. The tuner should be seated well back on a stool, backbone arched about 60 degrees, and hands outstretched as if the broadcast station were about to transmit a bucket of beer.

RIDE 'EM COWBOY

Q. I have no trouble in getting distant stations, but am unable to hold them. Everything seems unsteady and wavering and I am unable to stay on the station when I get on.

Jonathan Shake, Malaria, Fla.

A. Wear spurs. Tighten your dials and see that there are no sand burrs on your plug.

The Hunchback of Neutrodyne

The Hunchback of Neutrodyne! A human distortion from ceaseless work. Dumb as to radio. Blind to the outside world. Hard-hearted and cynical from disappointments, but with the patience of a veteran fisherman.

A WIRELESS PIANO

PIANO TUNER: "Where is the piano?"

BCL: "I have no piano, I want you to tune my radio."—*Leslie Carpenter.*

CYCLOLOGY

"Why is a broadcast station like a velocipede factory?"

"Because it makes cycles."—*Clifton Ask.*

A HOT ONE

Before inserting the tube into a newly built set, turn on the rheostat full and short the filament terminals with a short length of wire, observing the size of the spark. If a 22½ volt spark occurs, don't put the tube in. Take the set to a radio expert.

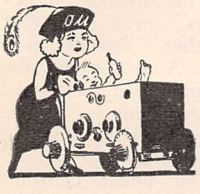
Contributed by W. S. Klein.

Radiotics

If you happen to see any humorous misprints in the press, we shall be glad to have you clip them out and send to us. **No RADIOTIC will be accepted unless** the printed original giving the name of the newspaper or magazine is submitted. Never mutilate clippings by underlining the misprint. We shall pay $2.00 for each **RADIOTIC** that is accepted and printed here. A few humorous lines from each correspondent should accompany each **RADIOTIC.** The most humorous ones will be printed. Address all **RADIOTICS** to

Editor **RADIOTIC DEPARTMENT,**
c/o Radio News

FOR THE RADIO BABY



The Radio Section of the New York *Sun & Globe,* dated May 17, 1924, contained the following Classified Advertisement which should prove of interest to Radio Mothers: Attention Amateurs! For Sale—GREBE CRIB, $65. Is it possible that Mr. A. H. Grebe added a new baby to his line of receivers or is the Crib a family heirloom?

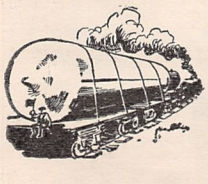
Contributed by George Emerson.

THE EFFECT OF THE GRID LEAK?

Watch out that your panel doesn't develop Bakelitis. We are informed through an advertisement appearing in the Radio Section of the New York *Telegram & Mail* of the following: For $10.00 we will drill, DRAIN, engrave your panel and assemble your parts. It is possible that we fail to gather the meaning of the word "Panel" and that this was not intended as a radio Ad!

Contributed by Arthur Wood.

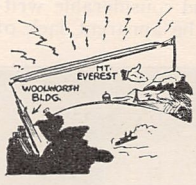
WHO WILL PAY THE FREIGHT?



The Kansas City *Journal Post* carried an advertisement of the Standard Radio Company, who have UV-201 FT. TUBES for sale at the low price of $4.50. Indeed, with one of these babies one should be able to obtain exceptional results. But there is the question whether or not the price is F.O.B.?

Contributed by F. J. Pshide.

SOME WAVE-LENGTH!



In the Roanoke (Va.) *World News* of May 17, 1924, appeared a notice that Radio Broadcast Station WDBJ of Roanoke, Va., would broadcast on "229 MILES." Imagine the inductance and capacity necessary! No doubt they connected the U. S. Navy in parallel with the Western Union Lines and stretched their aerial between the Woolworth building and Mount Everest.

Contributed by B. G. Richardson.

IT AUTO WORK!

The Denver *Post* carried the following Ad. which, to say the least, is rather confusing: *Two good 30 x 3½ tires with tubes for tube set;* evenings. 2824 Wyandot." Guess these are the rubber tired verniers we hear so much about, or are they balloon tires to take the shock out of UV-199 tubes?

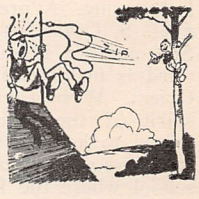
Contributed by George Meredith.

WHAT LANGUAGE THEY MUST USE?

The Star Crystal Co. in the June 7, 1924, issue of the *Radio Digest* advertise their "B-Metal *LOOSE* Talking Crystals." We can only say to this, do not invite the minister or your best girl to listen in on your radio if you are using one of these "bad actors."

Contributed by E. R. Tircher.

FIFTY FEET WILL GO A LONG WAYS



J. M. Waterston in the May 18, 1924, edition of the Detroit *News* advertises *Rubber Aerials* in 50, 75 and 100 ft. lengths. Now this is quite an idea. It should be possible to take a 50 ft. length and make it conform to a 100 ft. stretch. If one should let go, though!

Contributed by Alvin Hall.

SOME DIALS!

A clipping from the June 8, 1924, edition of the Newark (N.J.) *Sunday Call* advertises dials at the following prices: "Fada — $17.95, Work-Rite, $16.95, Shamrock, $9.95." No doubt they are solid silver, gold plated, ivory knobbed and inlaid with precious stones. No wonder one knob sets are popular!

Contributed by S. F. Phillips.

I Tappa Kee

A Fraternity of Commercial Operators

Dr. Lee De Forest operating the receiving set on board the S.S. Paris. He recently returned on this ship from a vacation abroad, accompanied by his wife and daughter. © Keystone View Co.

WHILE broadcast listeners' clubs have been organizing by the dozen and amateurs are on the verge of international organization, the commercial operators to whom radio work means bread and butter have not been entirely idle. Within the last two years a fraternity of these operators, together with student operators, has been organized at the radio school of the Oregon Institute of Technology in Portland, Oregon, and membership now includes nearly 100 radio men.

Unlike the broadcast listeners' clubs, the membership of the "I Tappa Kee" fraternity is widely scattered and addresses are constantly changing. At present one member is aboard a U. S. Coast Guard Cutter in the Bering Sea, another is sailing for Europe, and a third is making his 19th round trip to the Orient. Were it not for the strong fraternal spirit of these men it would be difficult indeed to keep in touch with them. There is always a group of student operators at the school where the I Tappa Kee's have their headquarters, and a member never fails to visit this group while in port. This group, headed by the "upper contact," is the one which meets to settle matters of interest to the operators, and it is they who administer the initiation and present the little gold pins which the members wear.

In order to keep its membership informed of the doings of their brother operators, a paper known as "The Lightning Jerker" is sent out occasionally. It is edited by the instructor of the student group, Mr. Lloyd H. Simson, who is a man of wide experience. Not infrequently, after some big storm, does he receive a letter from one of the I Tappa Kee's mentioning modestly in a paragraph or two some connection with an SOS he was called upon to answer.

It was one who had gone out from this student group who sent out messages from Port Moller, Alaska, telling of Major Martin's safety at a time when the country had given up hope.

Recently there has come the call to "Organize the commercial operators," and this might become the foundation of such an organization; that is, if a sufficient number of operators were to apply for associate membership. It has its possibilities, but the matter is up to the commercial men outside of the organization.

UPHOLDING YOUR PROFESSION

By HOWARD S. PYLE, A.M.I.R.E.

Much has been said and considerable written, of late, relative to the apparent lack of dignity attached to the position of radio operator aboard ship. The profession has even dropped so low, notably on a number of Great Lakes vessels, that radio operators are performing ordinary deck duties—washing down, scraping paint, etc., in addition to serving as operator. As a man, a radio operator is no better than any other of the ship's crew and officers—all men were created equal—but if he has demonstrated an ability to rise to a position of responsibility and trust why should he fall back down the ladder and accept a deck swab, a "holy stone" and a chipping hammer.

If the old time dignity is gone, whose fault is it? It must be laid entirely to the operator. In the old days, the reason was because the romance of the game attracted young fellows to whom the remuneration was secondary—the writer knows one chap who offered to pay $50 for the privilege of making a 10-day trip as radio operator at no salary! Naturally, a few moves like this placed the profession in contempt of other sea-going officers.

Then, too, a young fellow taking his first ship is generally pretty "chesty" and takes every opportunity to let his brother officers know that he is "Sparks," in a tone that would seem to imply that "Sparks" was synonomous to "King." A worse mistake could not be made! It must be remembered that there are still large numbers of the older captains who are opposed to radio on the grounds that it takes the ship out of their hands and keeps it under constant control of the owners through the medium of some "Smart Alec kid." The operator, therefore, should be humble and respect the seniority rights of the other officers, but at the same time maintain a dignified bearing and use the eyes and ears far more than the tongue. Above all, never tell the cap-

(*Continued on page* 368)

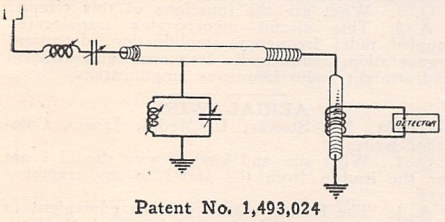
An interesting photo of the interior of the receiving room, Hirano Radio Station, Osaka, Japan. Note the loose couplers on the tables. Looks like old times. A large loop aerial can be seen at the extreme right of the photo.

By JOHN B. BRADY*

RADIO SIGNALING

(Patent No. 1,493,024, Louis Cohen and Joseph O. Mauborgne. Filed Aug. 6, 1920, issued May 6, 1924.)

Radio signaling utilizing a wave coil for the reduction of static disturbances and other interferences in the reception of radio signals. A long helix uniformly wound with wire is connected through a tuning circuit with the antenna and to ground. The radio receiving apparatus is connected with the wave coil and an adjustable



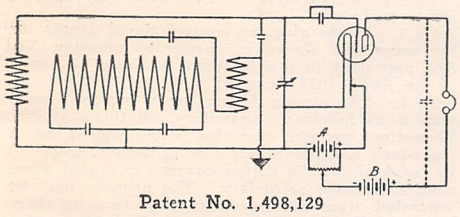
Patent No. 1,493,024

grounded metallic tube is provided in relation to the wave coil, which tube is electrically connected in a tuned circuit with ground. The adjustment of the metallic tube and the grounded loop circuit operates to change the electrical characteristics of the coil. Persistent waves set up in the wave coil will be received while foreign electrical disturbnces which may act on the antenna, such as electrostatic effects causing a shock excitation being of a steep wave front are rapidly damped out in their travel through the wave coil.

RADIO TELEPHONE RECEIVING APPARATUS

(Patent No. 1,498,129, A. E. Spicer. Filed June 5, 1923. Assigned to Thomas J. F. Coady, of New York. Issued June 17, 1924.)

Radio telephone receiving apparatus constructed in compact form and including a miniature pick-up loop. The tuning unit includes a primary coil having a tap at the center of the length of the coil. The ends of the coil are connected by a shunt



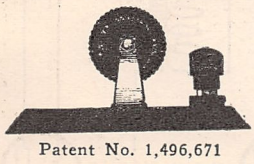
Patent No. 1,498,129

circuit through condensers. A rotary coil is positioned adjacent to each end of the primary coil. One of the rotary coils is connected in series with the primary coil and the other between the central tap and a ground connection. The receiving apparatus is connected across the tuning system with suitable amplification for bringing in signals.

CRYSTAL DETECTOR

(Patent No. 1,496,671, H. Gernsback. Filed Feb. 24, 1923, issued June 3, 1924.)

Detector of the crystal type where a sensitive crystal is enclosed by a casing which includes a feeler member in contact with the crystal. The feeler member comprises a central plate having



Patent No. 1,496,671

plane opposite faces and side plates having a plurality of contact feeler points thereon which contact with a plurality of sensitive points on the crystal. By this construction a crystal detector may be placed in permanent adjustment.

ELECTRICAL CONDENSER

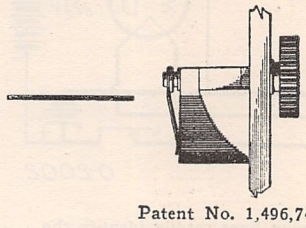
(Patent No. 1,495,577, Francis W. Dane. Filed April 3, 1920, issued May 27, 1924. Assigned to Wireless Specialty Apparatus Co., Inc., Boston, Mass.)

Electrical condenser of the stacked type where alternate sheets of mica and metal foil are placed within a casing with a resilient spring member compressing the stack under a pressure of the order of thousands of pounds while the stack is submerged in insulating material which is solid at ordinary temperatures but fluid at a temperature of the order of about 140 degrees centigrade. The construction described avoids the presence of air bubbles and forces the mica and foil in intimate contact with each other, securing high capacity but with high insulation properties.

POTENTIOMETER

(Patent No. 1,496,745, H. S. Scott. Filed June 13, 1923, issued June 3, 1924.)

Potentiometer in which the variation in resistance takes place in accordance with a logarithmic law. An insulating band which carries the resistance element is relatively wide at a central section, but decreases in width toward each end thereof on opposite sides of the central section. The resist-



Patent No. 1,496,745

ance wire is wound upon this band whereby relatively large increments of adjustment are secured within the central section while relatively small increments of adjustment are obtained within the tapered portions on each side of the central section.

MOLDED OIL FILLED CONDENSER

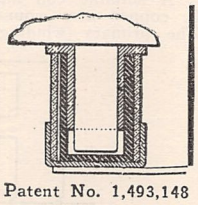
(Patent No. 1,497,415, Phillips Thimas. Filed April 21, 1921, issued June 10, 1924. Assigned to Westinghouse Electric and Mfg. Co.)

Molded oil filled condenser wherein alternate sheets of foil and solid dielectric are supported in a molded casing in position where a liquid dielectric may be filled in over the plates for increasing the insulating properties.

FUSE FOR VACUUM BULBS

(Patent No. 1,493,148, Montgomery B. Cohen. Filed July 23, 1920, issued May 6, 1924.)

Fuse for vacuum bulbs for protecting the filament from destructive effects of excessive current. The fuse consists of a cylindrical member which is applied to one of the bulb terminals and constructed to engage the corresponding socket contact.

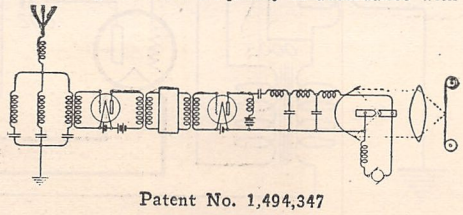


Patent No. 1,493,148

HIGH SPEED RADIO SYSTEM

(Patent No. 1,494,347, Lloyd Espenschield. Filed April 30, 1920, issued May 20, 1924. Assigned to American Telephone and Telegraph Co., Inc., New York.)

High speed radio system for accommodating a large volume of traffic over wave bands in close proximity to each other. The system consists in modulating a carrier frequency in accordance with



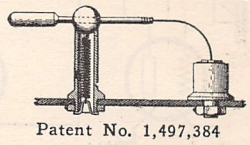
Patent No. 1,494,347

signaling current produced at a speed sufficiently high so that the band of frequencies resulting from modulation will be too wide for transmission through a sharply tuned selective circuit. The modulated band is selected with substantially negligible and uniform attenuation while adjacent frequencies lying outside of the bands will be sharply discriminated against by the use of band filters. At the receiving station a light stream is modulated in accordance with detected current and then the modulations recorded upon a medium sensitive to light.

RADIANT ENERGY RECEIVER

(Patent No. 1,497,384, H. G. Saal. Filed May 11, 1922, issued June 10, 1924.)

Radiant energy receiver consisting of a crystal detector construction where the catwhisker is supported by a spherical member seated upon a spher-



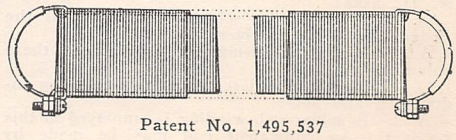
Patent No. 1,497,384

ically curved standard. A coil spring interior of the standard is secured to the surface of the spherical member, enabling the member to be freely adjusted to different angular positions.

CAGE ANTENNA

(Patent No. 1,495,537, Stephen F. Stafford. Filed Aug. 21, 1923, issued May 27, 1924. Assigned to Stafford Radio Co., Inc., of Mass.)

Double helix cage antenna for indoor use in radio reception. The antenna consists of two helices wound in opposing relation with respect to each other with one nested within the other, providing a strong cage antenna.



Patent No. 1,495,537

AMPLIFICATION OF MODULATED WAVES

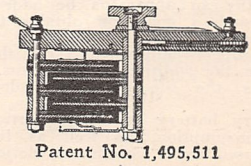
(Patent No. 1,494,908, Raymond A. Heising. Filed Feb. 23, 1923, issued May 20, 1924. Assigned to Western Electric Co., Inc., New York, N. Y.)

Amplification of modulated waves for securing economy in operation of high power systems. The amplification system may be applied to a system which includes a source of carrier waves, a device for deriving from the source a triple frequency component, amplifying this component and combining it with waves from the original source to produce a peaked wave; a carrier suppression modulating device for modulating the peaked wave thus produced in accordance with a low frequency wave; a voltage step-up or low power amplifier for the modulated wave; and a vacuum tube power amplifier having a grid so negatively polarized that the amplifier is actuated only by the peak portion of each cycle of the modulated peaked wave. The repeater derives from the modulated wave a triple frequency component of large energy where the energy is chiefly in side frequencies based upon the fundamental frequency, all of which energy is efficiently increased in amplitude through the amplification system of this invention.

CONDENSER

(Patent No. 1,495,511, Robert J. Fitzgerald. Filed May 12, 1920, issued May 27, 1924. Assigned one-half to J. Arthur Fischer, New York, N. Y.)

Condenser of the rotary variable construction

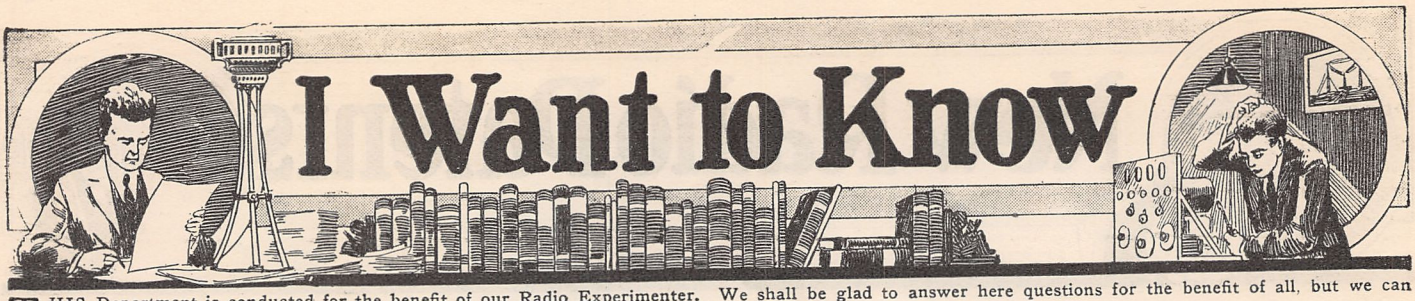


Patent No. 1,495,511

wherein the movable and stationary metallic plates have an outside insulating coating thereover. The insulating coating of each of the plates is adapted to contact one with the other, preventing the metallic plates from shunting each other.

(*Continued on page* 412)

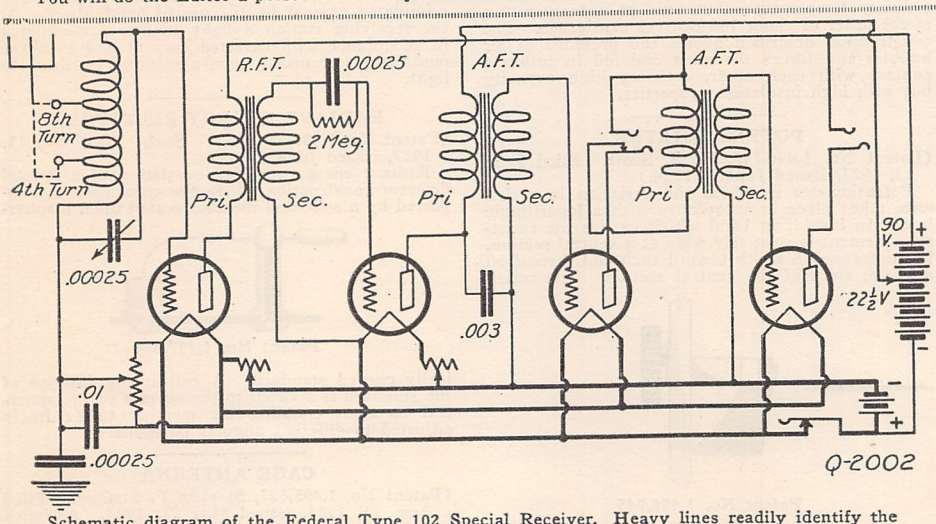
Patent Lawyer, Ouray Building, Washington, D. C.



THIS Department is conducted for the benefit of our Radio Experimenter. We shall be glad to answer here questions for the benefit of all, but we can publish only such matter as is of sufficient interest to all.

1. This Department cannot answer more than three questions for each correspondent.
2. Only one side of the sheet should be written upon; all matter should be typewritten or else written in ink. No attention paid to penciled matter.
3. Sketches, diagrams, etc., must be on separate sheets. This Department does not answer questions by mail free of charge.
4. Our Editors will be glad to answer any letter, at the rate of 25c for each question. If, however, questions entail considerable research work, intricate calculations, patent research, etc., a special charge will be made. Before we answer such questions, correspondents will be informed as to the price charge.

You will do the Editor a personal favor if you will make your letter as brief as possible.



Schematic diagram of the Federal Type 102 Special Receiver. Heavy lines readily identify the "A" battery circuit. A potentiometer shunted by a .01 mfd. fixed condenser controls the radio frequency amplifier tube.

FEDERAL TYPE 102 RECEIVER

(2002) Mr. O. Ingmar Oleson, Ambrose, N. D., asks:

Q. 1. What is the schematic diagram of the Federal Type 102 receiver?

A. 1. We are showing the diagram in these columns.

Q. 2. Please give description of the tuning inductance and set.

A. 2. A spider-web winding is employed in this receiver. An equivalent coil may be made by winding 55 turns of No. 22 D.C.C. copper wire on a three-inch tube. Taps for the aerial are taken off at the fourth and eighth turns. Series ground condensers of various values may be tried. The rotor plates of the variable condenser connect to the side of the circuit indicated by the arrowhead. Iron core radio frequency transformers, as shown, or air core transformers, may be used. A push-pull switch is used to control the filaments of the vacuum tubes.

MUTUAL CONDUCTANCE

(2003) Mr. Mark Wolf, Bellevue, Ohio, writes:

Q. 1. Where can iron core-wire be secured?

A. 1. Any hardware or electrical supply store will have it.

Q. 2. How can the mutual conductanc of a vacuum tube be determined?

A. 2. The amplification constant, multiplied by one million, when divided by the plate-to-filament impedance will give the mutual conductance in micro-mhos.

Q. 3. What maximum plate voltage is safe for Myers High-Mu tubes?

A. 3. The exceptionally high potential of 300 volts is allowable.

DRY BATTERY LIFE CURVE

(2004) Mr. Glen McIntyre, Avena, Ill., wants to know:

Q. 1. Why do the signals come in louder when certain parts of the set are touched?

A. 1. Probably because the grid leak requires adjusting or the circuits are not in tune.

Q. 2. May an apparatus be added to a set in which such a condition obtains to take the place of one's hand?

A. 2. Proper adjustment is the remedy rather than the addition of apparatus.

Q. 3. Is the life curve for dry batteries straight?

A. 3. Dry battery life is proportional to the current consumption, as well as to the time they are used for a continuous period.

ULTRADYNE

(2005) Mr. Elias Nusbaum, Philadelphia, Pa., wants to know:

Q. 1. I cannot find any reference in the Ultradyne article, which appeared in the February issue of RADIO NEWS, to Figs. 4 and 5.

A. 1. Reference to these figures (interior photographs of the set), is made in paragraph three, first column, page 1059.

Q. 2. Can the Ultradyne equipment be used in a standard Super-Heterodyne circuit?

A. 2. These parts may be used and with very nearly the same connections. A little study of the two circuits will show the two or three changes necessary in the wiring.

Q. 3. Will it be necessary to rewire the modulator circuit as a first detector?

A. 3. Best results will be had by operating the first tube as the detector, if the standard Super-Heterodyne circuit is desired.

TRIRDYN

(2006) Mr. Edward E. Walsh, Lancaster, N. Y., asks:

Q. 1. Please show the diagram of connections of the Crosley Model 3R3 Trirdyn.

A. 1. This diagram is shown here.

Q. 2. How may the coils be constructed?

A. 2. A standard neutroformer may be used for coil "A." A suitable coil has 45 turns of No. 22 D.C.C. copper wire wound on a three-inch form. The primary winding is made by placing about 15 turns of the same size wire directly over the secondary. A few layers of paper or Empire cloth may be used to insulate the two layers. Unit "B" may be a standard variocoupler with about eight turns of wire wound over the primary, for the B1, winding.

Q. 3. What are the functions of this circuit?

A. 3. This circuit incorporates transformer-coupled radio frequency amplification, detection, regeneration, reflex audio frequency amplification and straight audio frequency amplification.

AERIAL WIRE

(2007) Mr. Stewart L. Medill, Jaroso, Colorado, writes:

Q. 1. What size and kind of wire should I use for the lead-in from the aerial to my receiving set?

A. 1. The lead-in wire should be equivalent to the aerial. If a multi-wire aerial is used, the lead-in may be composed of as many strands (each of the same size as the aerial wire), as there are in the aerial, or it may consist of one wire having a conductivity equal to the total of the number of wires in the aerial.

Q. 2. What size and kind of wire should I use for the ground wire?

A. 2. No. 4 weather-proof, rubber-covered wire, or the equivalent of the lead-in, is standard.

Q. 3. Can rubber insulated aerial wire be used to advantage?

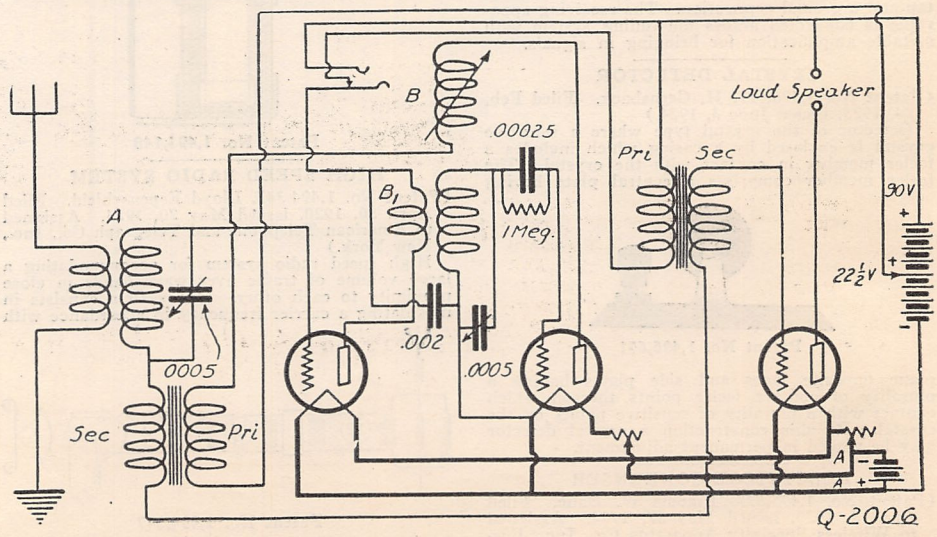
A. 3. This wire has the disadvantage of added weight. Reception is practically the same, using either bare or insulated wire. The insulated wire has the advantage of not corroding. This corrosion would considerably reduce the efficiency of the aerial. The insulated wire has the disadvantage of becoming unsightly in time, due to the action of the elements.

WAVE TRAP DESIGN

(2008) Mr. Walter E. Oestreich, Fulton, Mo., wants to know:

Q. 1. Please give me constructional details for the wave trap shown in answer to question No. 892, appearing in the "I Want to Know" columns of the April, 1924, issue of RADIO NEWS.

A. 1. The proper design for a two-coil wave-trap is as follows: Secondary, 50 turns of No. 22 cotton covered enameled wire, wound on a three-inch bakelite tube. The primary consists of 10 turns of No. 18 cotton covered enameled wire, wound over the secondary. The primary may be separated from the secondary by two or three layers of Empire cloth, or several match sticks, well shellacked, may be fastened to the secondary with shellac, and the primary wound on these sticks.



The 3-control Trirdyn circuit is capable of high amplification. One tube is reflexed. It consists of one stage of tuned radio frequency amplification, a detector and two stages of audio frequency amplification.

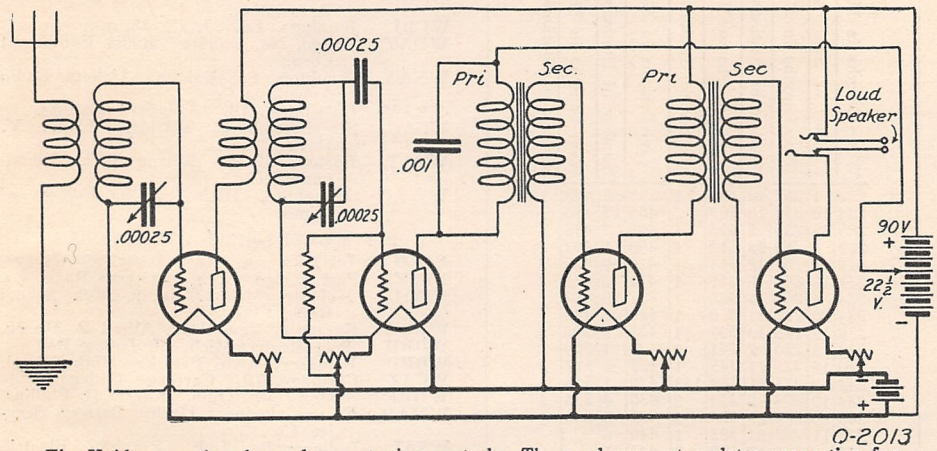
Q. 2. Can a 43-plate condenser be used?
A. 2. Use a 23-plate condenser, it will be better.
Q. 3. Will a wave-trap eliminate static and spark transmitter interference?
A. 3. A wave-trap will reduce static interference only slightly. It will considerably reduce most spark transmitter interference. If the spark transmission is exactly on the adjustment of the broadcast station, it will not be possible to eliminate the spark (code) sending station signals without doing likewise to the broadcast transmission.

AMPLIFIER REFERENCES

(2009) Mr. Raphael Peluso, Brooklyn, N. Y., requests:
Q. 1. What type of radio amplification is suggested for one who is hard of hearing?
A. 1. It is necessary, in designing an amplifier for this particular purpose, to use exceptional care. Otherwise, distortion will be so great as to make the reception very difficult to interpret by one who is hard of hearing, although it will be quite understandable to those more fortunate. An excellent distortionless amplifier was described by H. J. Round in the July issue of this magazine. The June issue also contains a very good article by Clyde J. Fitch on the same type of amplifier. If the first stage of amplification is transformer-coupled, high amplification without distortion may be had by adding push-pull transformer-coupled amplification. This method of increasing the signal strength has been described in these columns from time to time.

LOOSE COUPLER

(2010) Mr. Vincent Parmigiano, Newark, N. J., asks:
Q. 1. Please show a diagram of connections for a loose coupler.



The Unidyne receiver has only two tuning controls. The condenser rotor plates connection for least capacity effect is indicated by the arrowhead location, the point of the arrow designating the side upon which are the rotor plates.

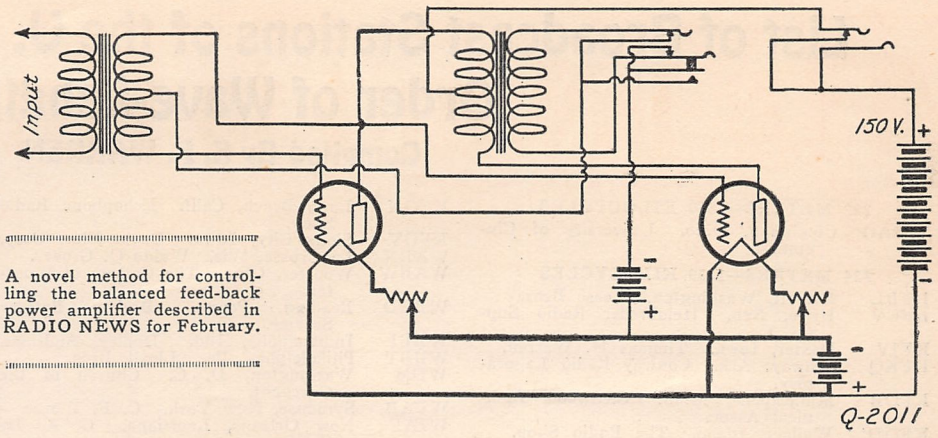
A. 1. Any of the many diagrams using variocouplers, as shown in these columns, may be used. A variocoupler is connected in the same manner as a loose coupler.

BALANCED FEED-BACK POWER AMPLIFIER

(2011) Mr. Watkins Williams, Kansas City, Mo., requests:
Q. 1. What is the diagram of connections for the balanced feed-back power amplifier, described in the February, 1924, issue of RADIO NEWS, in order to use the amplifier with or without the feed-back feature, as desired?
A. 1. A diagram of connections is shown. The "C" battery may be left out if a low amplifier voltage is used. Loudest signals will be had with a high plate voltage.
Q. 2. What type of tubes will give good results in this amplifier?
A. 2. High vacuum tubes, such as the Myers, DV-2, UV-201A, C-301A, UV-202, C-302, W.E.-216A or W.E.-203B will give excellent results.
Q. 3. What is the advantage of the UV-199 tube?
A. 3. Its outstanding feature is an extremely high electron emission at a low filament current consumption and temperature.

TUBE DATA

(2012) Mr. Chas. M. Schock, Chicago, Ill., wants to know:
Q. 1. What is the difference between the UV-199 tube and the C-299 tube?
A. 1. The former is manufactured for the Radio Corporation of America, by the General Electric or Westinghouse Tube Laboratories. The latter is manufactured for E. T. Cunningham, Inc., by the General Electric Company.
Q. 2. Should the inside of these tubes be plain or colored, for best results as amplifiers?
A. 2. The color of the tubes has absolutely no bearing on their use in any radio circuit.



A novel method for controlling the balanced feed-back power amplifier described in RADIO NEWS for February.

Q. 3. If it were possible to use all the current registered by an ammeter connected to three new dry cells which are connected in series, how long could a UV-199 tube be operated?
A. 3. Taking an arbitrary figure of 30 amperes for the battery, the filament could burn for 500 hours. This efficiency cannot be developed in practice.

UNIDYNE

(2013) Mr. Bill McMahon, Waterbury, Conn., asks:
Q. 1. What is the diagram of connections employed in the Unidyne?
A. 1. This circuit is shown in these columns.
Q. 2. How are the radio frequency transformers constructed?
A. 2. The exact construction of these transformers has not been made public. A suitable inductance for the first transformer is made by winding 50 turns of No. 22 C.C copper wire on a three-inch tube. Over this is wound about 10 turns of the same size wire. The second transformer may have the same size secondary on the same size tube, but the primary has only eight turns of wire and is separated from the secondary by about one-quarter inch.

MISCELLANEOUS

(2014) Mr. Ottus Wheat, Belton, Texas, requests:
Q. 1. What are the characteristics of the DeForest DV-2 tube?
A. 1. This tube may be used as a detector or amplifier; 150 volts is the maximum amplifier plate voltage, and 60 is the maximum detector plate voltage. A 10-ohm rheostat connected in the negative lead is satisfactory for operation on a 6-volt supply. The current consumption is one-quarter ampere. This tube functions best as a power amplifier.
Q. 2. Can an "S" tube rectifier be used for a 250 watt set?
A. 2. Since the out-put of the "S" tube is somewhat limited best results will be had by using hese tubes for stations up to 50-watt size. The most economical operation of larger sets will be had by the use of a motor-generator or a chemical rectifier.
Q. 3. What is the average current required for the proper operation of a button microphone?
A. 3. The average current required is 20 milliamperes.

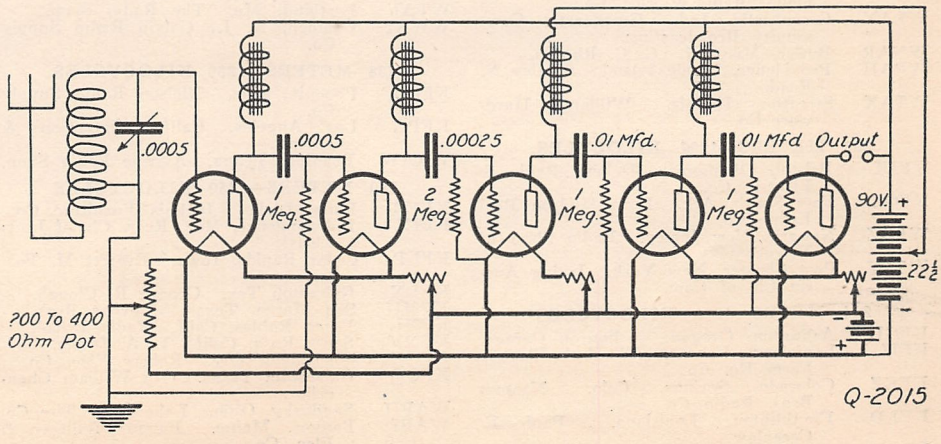
CHOKE COIL AMPLIFICATION

(2015) Mr. Jos. M. Laffley, Philadelphia, Pa., asks:
Q. 1. Please show a diagram of a set incorporating two stages of radio frequency amplification, tube detector and two stages of audio frequency amplification, using choke coil amplification throughout.
A. 1. The system of connections is shown in these columns.
Q. 2. What tuning system should be employed?
A. 2. We are showing an aperiodic antenna tuning system. A 54-turn coil is shown. This coil is tapped, four turns from one end.
Q. 3. What type of impedance should be used?
A. 3. Spark coil secondaries or audio frequency transformer secondaries may be used, or their equivalent.

BEAM TRANSMISSION

(2016) Mr. R. H. Peny, San Antonio, Texas, requests:
Q. 1. I have a number of telephone inductance coils of various sizes, as well as several coils using various types of windings. How can these be used in radio circuits?
A. 1. Not knowing the constants of these coils, we can suggest no use for them.
Q. 2. What are the advantages of direction finders?
A. 2. By their use, ships in a fog may safely pass one another.

(*Continued on page* 366)



Amplification at both radio and audio frequencies may be had by the use of choke coils, in the manner shown in the diagram. Note that fixed condensers of different capacity values are connected in series with the respective grid circuits.

List of Broadcast Stations of the U. S. and Canada in Order of Wave-Lengths

Compiled By E. F. WARREN

222 METERS—1350 KILOCYCLES

WHAG Cincinnati, Ohio. University of Cincinnati.

224 METERS—1339 KILOCYCLES

KFBL Everett, Washington. Leese Bros.
KFGV Utica, Neb. Heidbreder Radio Supply Co.
KFJV Dexter, Iowa. Thomas H. Warren.
KFKQ Conway, Ark. Conway Radio Laboratory.
KFOB Minneapolis, Minn. Glenwood Technical Assoc.
KFOD Wallace, Idaho. The Radio Shop.
KFPB Seattle, Wash. Edwin J. Brown.
WBBU Monmouth, Ill. Jenks Motor Sales.
WIAJ Neenah, Wis. Fox River Valley Radio Supply Co.
WRAF La Porte, Indiana. Radio Club, Inc.

226 METERS—1326 KILOCYCLES

KFFR Sparks, Nevada. Jim Kirk.
KFFZ Dallas, Texas. Al. G. Barnes Amusement Co.
KFGQ Boone, Iowa. Crary Hardware Co.
KFHD St. Joseph, Missouri. Utz Electric Co.
KFIU Juneau, Alaska. Alaska Elec. Light & Power Co.
KFJW Towanda, Kansas. Le Grand Radio Co.
KFOR David City, Nebraska. David City Tire & Elec. Co.
KFOY St. Paul, Minn. Beacon Radio Service.
WABU Camden, New Jersey. Victor Talking Mach. Co.
WBBM Lincoln, Ill. Frank Atlas Produce Co.
WBCI Bemis, Tenn. Nicoll, Duncan & Rush.
WIAO Marion, Ind. Chronicle Publishing Co.
WKAN Montgomery, Alabama. United Battery Service Co.
WTAQ Osseo, Wis. S. H. Van Gordon & Son.
WTAY Oak Park, Illinois. Oak Leaves.
WWAB Trenton, New Jersey. Hoenig, Severn & Co.

227 METERS—1329 KILOCYCLES

WBBZ Indianapolis, Ind. Noble B. Watson.
WWAE Joliet Illinois. Alamo Dance Hall.

229 METERS—1310 KILOCYCLES

KFFO Hillsboro, Oregon. Dr. E. H. Smith.
KFHX Hutchinson, Kansas. Robert Nelson.
KFJX Cedar Falls, Iowa. Iowa State Teachers' College.
KFLV Rockford, Ill. Rev. A. T. Frykman.
KSS Long Beach, Calif. Prest & Deon Radio Elec. Co.
WCBM Baltimore, Md. Charles Swarz.
WJD Granville, Ohio. Dennison University.
WOAR Kenosha, Wis. H. P. Lundskow.
WSAN Allentown, Penna. Allentown Radio Club.

231 METERS—1298 KILOCYCLES

KFER Fort Dodge, Iowa. Auto Electric Service Co.
KFLY Fargo, N. D. Fargo Radio Supply Co.
KFMT Minneapolis, Minn. Dr. Geo. W. Young.
KFNZ Burlingame, Calif. Royal Radio Co.
KFOT Wichita, Kansas. College Hill Radio Club.
WHAR Atlantic City, New Jersey. Paramount Radio & Elec. Co.
WLAX Greencastle, Ind. Greencastle Community Broadcasting.
WNAR Butler, Missouri. C. C. Rhodes.
WRAH Providence, Rhode Island. Stanley N. Read.
WTAX Streator, Illinois. Williams Hardware Co.

233 METERS—1287 KILOCYCLES

KFJK Bristol, Oklahoma. Delono Radio & Electric Co.
KFOZ Fort Smith, Ark. Leon Hudson Real Estate Co.
WRAZ Newark, New Jersey. Radio Shop of Newark
WSAY Port Chester, New York. Irving Austin Ch. of Com.

234 METES—1281 KILOCYCLES

KFGL Arlington, Oregon. Arlington Garage
KFIL Lonisberg, Kansas. Windisch Electric Farm Eq. Co.
KFKZ Colorado Springs, Colo. Nassom Bros. Radio Co.
KFLD Franklinton, Louisiana. Paul E. Greenlaw.
KFNC Corsicana, Texas. Alonzo Monk, Jr.
KFNV Santa Rosa, Calif. L. A. Drake.
KFOL Marengo, Iowa. Leslie M. Schafbush.
KFON Long Beach, Calif. Echophone Radio Shop.
KFOV Sioux City, Iowa. Davis Elec. Corp.
WABN La Crosse, Wis. Waldo Q. Grover.
WABW Wooster, Ohio. The College of Wooster.
WBBD Reading, Penna. Barbey Battery Service.
WBBI Indianapolis, Ind. Dudley Andrews.
WBBT Philadelphia, Pa. Lloyd Bros.
WDM Washington, D. C. Church of the Covenant.
WFAB Syracuse, New York. C. F. Woese.
WIAF New Orleans, Louisiana. G. A. De Cortin.
WIK McKeesport, Penna. K & L. Electric Co.
WLAH Syracuse, New York. Samuel Woodworth.
WQAC Amarillo, Texas. E. B. Gish.

236 METERS—1270 KILOCYCLES

KFLU San Benito, Texas. Rio Grande Radio Supply House.

TABLE OF NUMBER OF STATIONS WORKING ON EACH WAVE-LENGTH

Wave-Lengths in Meters.	Number of Stations.	Wave-Lengths in Meters.	Number of Stations.	Wave-Lengths in Meters.	Number of Stations.	Wave-Lengths in Meters.	Number of Stations.	Wave-Lengths in Meters.	Number of Stations.
222	1	252	14	294	1	395	3	448	1
224	10	254	16	309	2	400	13	450	5
226	16	256	3	310	1	405	2	455	2
227	2	258	12	312	1	406	1	462	1
229	9	261	18	314	1	410	9	469	3
231	10	263	9	319	1	411	2	476	2
233	4	265	1	326	1	417	2	484	2
234	20	266	11	330	1	420	3	492	3
236	13	268	13	337	1	421	1	500	3
238	3	270	7	341	2	423	1	509	3
240	18	273	13	345	1	425	2	517	2
242	9	275	11	360	163	429	1	526	1
244	12	278	7	370	2	430	4	536	1
246	10	280	23	380	2	435	2	546	1
248	11	283	23	385	1	440	6		
250	6	286	12	390	3	441	1		

KFNH Springfield, Mo. State Teachers' College.
KFOC Whittier, Calif. First Christian Church.
WCBF Pittsburgh, Pa. Paul J. Miller.
WCBG Pascagoula, Miss. Howard S. Williams.
WCBQ Nashville, Tenn. First Baptist Church.
WFAH Port Arthur, Texas. Electric Supply Co.
WNAV Knoxville, Tennessee. People's Teleg. & Tel. Co.
WPAR Beloit, Kansas. Ward Battery & Radio Co.
WQAW Washington, D. C. Catholic Univ. of Amer.
WRAN Waterloo, Iowa. Blackhawk Elec. Co.
WTAJ Portland, Me. The Radio Shop.
WWAF Camden, N. J. Galvin Radio Supply Co.

238 METERS—1260 KILOCYCLES

KFCB Phoenix, Ariz. Nielson Radio Supply Co.
KFPG Los Angeles, Calif. Garretson & Dennis.
WRAW Reading, Penna. Avenue Radio Shop.

240 METERS—1250 KILOCYCLES

KFFB Boise, Idaho. Jenknis Furniture Co.
KFIX Independence, Mo. Reor. Ch. of Jesus Christ.
KFLP Cedar Rapids, Iowa. Everett M. Foster.
KFLX Galveston Tex. George R. Clough.
KFMU San Marco, Texas. Stevens Bros.
KFNL Pasco Robles, Calif. Radio Broad.
KFNV Santa Rosa, Calif. L. A. Drake.
KFOF Marshfield, Ore. Rohrer Elec. Co.
KFOQ Galveston, Texas. Ora William Chancellor.
WABH Sandusky, Ohio. Lake Shore Tire Co.
WABI Bangor, Maine. Bangor Railway & Elec. Co.
WBBA Newark, Ohio. Newark Radio Laboratories.
WBBG Mattapoisett, Mass. Irving Vermilya.
WCAT Rapid City, So. Dak. So. Dakota Sch. of Mines.
WKAD East Providence, R. I. Chas. Looff.
WOAX Trenton, New Jersey. F. J. Wolff.
WQAF Sandusky, Ohio. Sandusky Register.
WTAN Matoon, Ill. Orndorf Radio Shop.

242 METERS—1239 KILOCYCES

KFIQ Yakima, Wash. Yakima Valley Broadc'st'g Assn.
KFJL Ottumwa, Iowa. Hardscog Mfg. Co.
WABY Philadelphia, Pa. John Magaldi, Jr.
WCBH Oxford, Miss. University of Mississippi.
WGV New Orleans, La. Interstate Elec. Co.
WOAV Erie, Penna. Pennsylvania National Guard.
WQAD Waterbury, Conn. The Whitall Electric Co.
WRAV Yellow Springs, Ohio.. Antioc College.
WTAP Cambridge, Ill. Cambridge Radio & Elec. Co.

244 METERS—1229 KILOCYCLES

KDPT San Diego, Calif. Southern Electric Co.
WABN La Crosse, Wis. Ott Radio, Inc.
WABS Newark, New Jersey. Essex Mfg. Co.
WBAN Paterson, New Jersey. Wireless Phone Corp.
WBBR Rossville, N. Y. City. People's Pulpit Association.
WCBJ Jennings, La. J. C. Maus.
WDAY Fargo, No. Dakota. Radio Equipment Corp.
WNAX Yankton, So. Dakota. Dakota Radio Apparatus Co.
WRAM Galesburg, Ill. Lombard College.
WSAG St. Petersburg, Florida. Loran V. Davis.
WTAT Boston, Mass. Edison Elec. Illuminating Co.
WWAO Houghton, Mich. Mich. College of Mines.

246 METERS—1219 KILOCYCLES

KFID Iola, Kansas. Ross Arbuckle's Garage.
KFJY Fort Dodge, Iowa. Tunwall Radio Co.
KFOJ Moberly, Mo. Moberly High School Radio Club.
WBBE Syracuse, New York. Alfred R. Macey.
WBBH Port Huron, Mich. J. Irving Bell.
WBBP Petoskey, Mich. Petoskey High School.
WCAZ Carthage, Ill. Carthage College.
WDBF Youngstown, Ohio. Robert G. Phillips.
WMAP Easton, Penna. Utility Battery Service Co.
WSAL Indianapolis, Ind. Franklin Electric Co.

248 METERS—1209 KILOCYCLES

KFDO Bosemon, Mont. H. Everett Cutting.
KFGD Chickasha, Oklahoma. Chickasha Radio & Elec. Co.
KFJB Marshalltown, Iowa. Marshall Electric Co.
KFLB Menominee, Mich. Mich. Signal Elec. Mfg. Co.
KFOX Omaha, Neb. Board of Education, Tech. High.
KMJ Fresno. Calif. San Joaquin Light & Power Corp.
WBBV Johnstown, Pa. Johnstown Radio Co.
WGAL Lancaster, Pa. Lancaster Elec. Supply & Cons. Co.
WRAL St. Croix Falls, Wis. Northern States Power Co.
WSAH Chicago, Ill. A. G. Leonard, Jr.
WTAB Fall River, Mass. Fall River Daily Herald.

250 METERS—1200 KILOCYCLES

KFGX Orange, Texas. First Presbyterian Church.
KFMZ Roswell, N. M. Roswell Broadcasting Club.
WBBO Rogers, Mich. Mich. Limestone & Chemical Co.
WBBS New Orleans, La First Baptist Church.
WJAS Pittsburgh, Penna. Pittsburgh Radio Supply House.
WMAV Auburn, Ala. Alabama Polytechnic Inst.

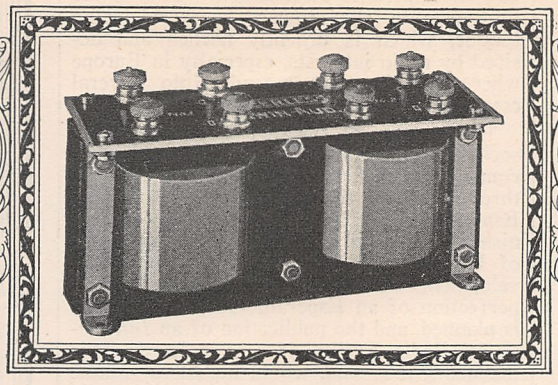
252 METERS—1190 KILOCYCLES

KFCY Le Mars, Iowa. Western Union College.
KFDD Boise, Idaho. St. Michael's Cathedral.
KFHA Gunnison, Cal. Colorado State Normal School.
KFIO Spokane, Wash. North Central High School.
KFJF Oklahoma City, Okla. National Radio & Mfg. Co.
KFJI Astoria, Oregon. E. E. Marsh & Liberty Theater.

(Continued on page 376)

The PEERLESS TWIN-AUD

LIST PRICE $9.50



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CLEARER REPRODUCTION

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Why use two ordinary transformers at added cost when one TWIN-AUD will give greater results.

Completely shielded	*More compact*	*Finer in appearance*	*More substantial in construction*

It can be used in any circuit of audio amplification. Recommended for super heterodyne and neutrodyne.

Greater output per stage than any other A F transformer. It can be used with any make of amplifier tube.

It stands out in performance as it stands out in appearance.

The PEERLESS KONDENSER-KIT

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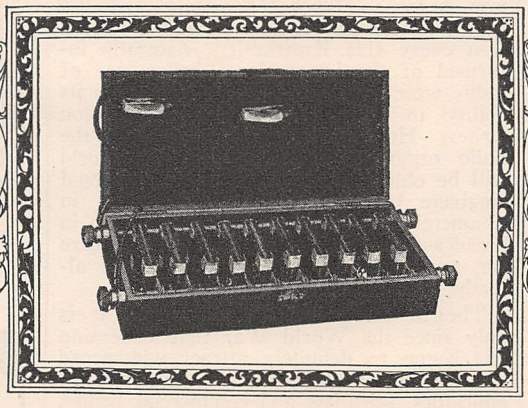

LIST PRICE $6.00

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Adaptable to all mountings. Provided with tabs for soldering.

Can be used with Grid Leaks, as series Antenna, Telephone, By-Pass Condensers, etc.

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10 thoroughly tested constant capacity low loss mica condensers

2-.0001 mfd.	1-.001 mfd.
2-.0002 mfd.	1-.002 mfd.
2-.0005 mfd.	1-.003 mfd.
1-.005 mfd.	

Total capacity .0126
Adjustable in .0001 mfd. steps.

126 CAPACITIES

Know the capacities for all circuits—don't guess them. The Peerless Kondenser Kit eliminates the purchase and use of wrong condensers by enabling the experimenter to determine in advance the exact capacities required for best results.

By means of the flexible leads and clips provided it is a simple matter to determine quickly and accurately by trial what capacity gives the best results at any point in a circuit.

The condensers in the Kit can be permanently connected in any circuit, and may be used wherever fixed condensers are necessary. Peerless condensers may be purchased individually to replace any taken from the kit.

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Gentlemen:—

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Signed

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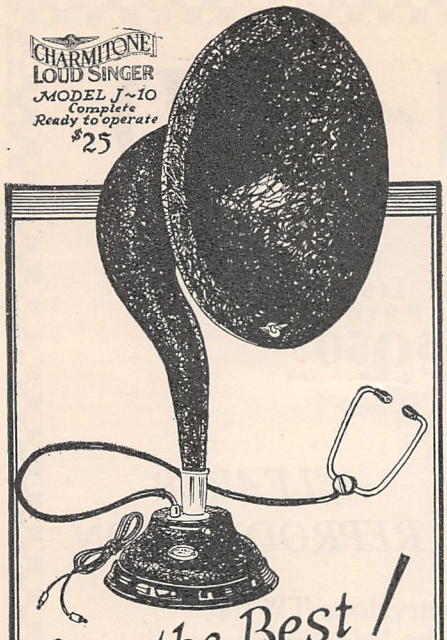

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LOUD SINGER

a musical instrument for the Radio

THE Dual-Charmitone is more than a standard loud speaker,—it is a LOUD SINGER,—a charmingly mellow and clear toned musical instrument.

Besides its splendid performance, it has exclusive mechanical features which make its operation easy and "foolproof." DUAL ACTION,—tuning and amplifying off the same masterphone by the simple turn of a switch. Once installed, it becomes a stationary fixture.

No shifting of plugs, no change in sound volume when shifting from head set to horn,—no chance of losing station.

SUPERSENSITIVE STETHOSCOPE head set, eliminates the use of expensive head phones, saves bother of plugging in on several jacks.

Any number of stethoscope sets may be used without losing sound volume or putting additional burden on batteries.

To get the most out of your Radio Buy the Dual-Charmitone!

MODEL J-10 with large horn and stethoscope set, complete, ready to operate **$25.**

MODEL H-8 with smaller straight horn and stethoscope set, complete, ready to operate **$18.50**

EXTRA STETHOSCOPE SET with forked plug and rubber hose, complete **$1.50**

Dual Loud Speaker Co. Inc.
210 West 54th St., New York, U. S. A.

SEEK TO MAKE ESPERANTO WORLD RADIO LANGUAGE

Seeking to establish Esperanto as the means of universal communication via radio, an International Radio Association has been formed in London, according to an announcement made by the Secretary of the Boston Esperanto Association. This is the first definite step toward a world radio tongue, which is urgently needed and desired by radio interests, especially in Europe where broadcasting extends into several countries.

The purpose of the new international association is to provide an easy means of communication between people of the world, through using the international language, Esperanto, over the radio. It seeks to furnish technical aid and information by means of Esperanto to those interested in the development of radio communication. The perfection of an Esperanto-Radio dictionary is planned, and the publication of an *International Radio Review* is contemplated. This magazine, it is said, would include a résumé in Esperanto of original articles on radio developments from many languages, placing at the disposal of all readers many technical documents not now available.

Dr. Pierre Corret, of Versailles, France, an eminent Esperantist and radio expert, has been selected as president, and Harry A. Epton, of the British Esperanto Association, at London, is serving as honorary Secretary. According to the latter, the association welcomes members from the world's radio fans, professionals and amateurs, whether they are Esperantists or not, and invites communication with the Secretary of the Esperanto Association of North America, at Boston.

The backers of the new association point out that due to the rapid growth of amateur radio communication between foreign countries, and the extension of broadcasting over seas, the need of a simple, neutral language is being felt more strongly than ever before. Hence the adoption of Esperanto as a world radio language is sought. "On every side Esperantists, naturally informed of the international importance of radio, were among the first to recognize its ability to unite the world," Mr. Epton writes. He anticipates that very soon the radio organizations throughout the world will be obliged to consider an international language to carry on communications in commercial and amateur traffic and even in broadcasting. Radio fans would not care for several translations of an address already transmitted in one language.

Though established 28 years ago, it is only since the World War that Esperanto has begun to definitely attract widespread and serious attention from governments, educators, scientists and commercial bodies. The spring term of the College of the City of New York, includes a course on Esperanto, which it introduces because of the need for a universal auxiliary language, stating that, of those in existence, Esperanto is the most extensively used. Already it has been used "on the air" here and further use is planned.

Briefly, Esperanto is described as being formed from the best of existing languages, from which were selected the greatest common factors, the conveniences and the words easily pronounced. It was designed for use between people of different nationalities. It is declared to be free from exceptions, the bane of many languages, while its spelling is phonetic. The pronunciation is simple and the grammar easily learned, exponents of this form of speech state.

World-wide activities of the Esperantists are increasing of late, and the 16th world congress of these organizations will be held in Vienna, August 6 to 14th, 1924, at which time the application of the language to radio will be discussed.

BUILD "Practical" Sets for Practical Results

For the man who wants to select a Radio Receiving Set that is practical, efficient, tried and tested by time, the E. I. Co. Book No. 2 will be invaluable to him. This book contains a selection of the best practical Radio Hookups on the market today from the small but efficient crystal Receiving set to the standard Radio and Audio frequency hookups so popular today.

The book gives complete instructions on how to build each set, with a wiring diagram of each circuit. It is profusely illustrated and is written in plain language so that the instructions can be followed quickly and easily.

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BOOK No. 2 HOW TO MAKE PRACTICAL RADIO RECEIVING SETS, size 5½x7¾ inches, 48 pages. Profusely illustrated, bound in stiff cardboard two-color printed cover.

You can obtain one of these books at your local Radio Dealer or by writing direct and enclosing 25c to

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SUPERHETERODYNE

Now you can Build Superheterodyne in a one, two, three or eight tube circuit with Radio Doctors' Superheterodyne parts. Ask your dealer or write to us today for FREE BULLETIN on "How to Build a Superheterodyne."

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FOR BLUE SEAL GUARANTEED RADIO
If you have $500 to $1,000, and have a store or can get suitable space in a store, tell us about it and we will consider appointing you as our representative in your community.
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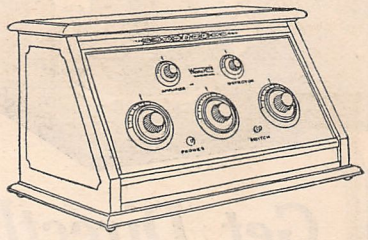
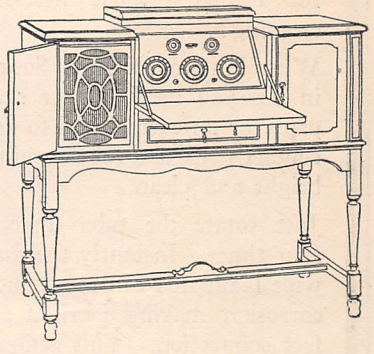
1406-8 South Michigan Ave., Chicago, Ill.

WORKRITE RADIO SETS WORKRITE

WorkRite Radio-King, a five tube (2 radio amplifier, 1 detector and 2 audio amplifier) super neutrodyne receiver. Beautiful mahogany cabinet, 22 in. x 20 in. x 14 in. This set operates with outdoor or indoor aerial and is highly selective. Long distance stations come in full and clear on the built-in loud speaker. Complete except tubes, batteries and aerial wire - - **$220.**



WorkRite Air-Master, same as Radio-King except without built-in loud speaker. Mahogany cabinet 21 in. x 14 in. x 14 in. Without batteries and loud speaker, tubes or aerial, **$160.**



WorkRite Aristocrat, a most beautiful mahogany console model 42 in. x 40 in. x 20 in. This set employs the same super-neutrodyne receiving apparatus. The cabinet contains a built-in loud speaker and space for A and B batteries. Not only a wonderful receiving set but also a charming piece of furniture. Complete except tubes, batteries and aerial - - **$350.**

True radio enjoyment

AFTER the first thrill of radio, the real enjoyment comes from the consistent ability of your set to get the program you want—to tune out local stations—to bring in music even from far distant stations with clear, true tone on the loud speaker.

In WorkRite super-neutrodyne sets you find all of these qualities as well as freedom from any whistles or howls. These sets are built into beautiful mahogany cabinets with matched mahogany panels and dials, and have many new and exclusive WorkRite refinements.

WorkRite sets—quality instruments in every way—are built to give their owners long years of true radio enjoyment.

See these sets at your dealer, or write for the new illustrated literature

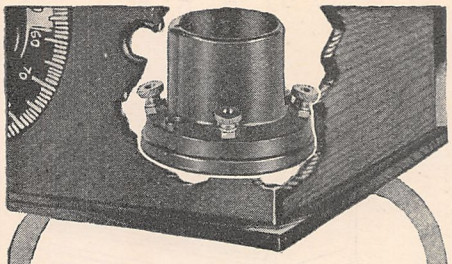
The WorkRite Manufacturing Co., 1806 East 30th St., Cleveland, O.

New York City, 1023 Knickerbocker Bldg. : Chicago, 536 Lake Shore Dr. : Los Angeles, 239 So. Los Angeles St.

WORKRITE

SUPER NEUTRODYNE RADIO SETS

Licensed under Hazeltine Patent Nos. 1,450,080—1,489,228



Get Directly at Them

Are the contacts in the sockets of your radio set easily accessible for ordinary and necessary cleaning?

With Na-ald DeLuxe Sockets in use you need neither sandpaper or an extra reach to keep contact strips and tube terminals bright and clean.

Just rotate the tube three or four times. Instantly the dual-wipe laminated contacts remove corrosion, making a bright perfect connection. This action is on the side of the tube terminals away from the soldered ends. *"It's the contact that counts."*

Make your Superheterodyne set free from socket trouble by using Na-ald DeLuxe Sockets.

Sockets and panel mounts for all tubes. Prices 35c to 75c. Send for catalog.

Alden Manufacturing Company
Dept. K, Springfield, Mass.

Correspondence from Readers

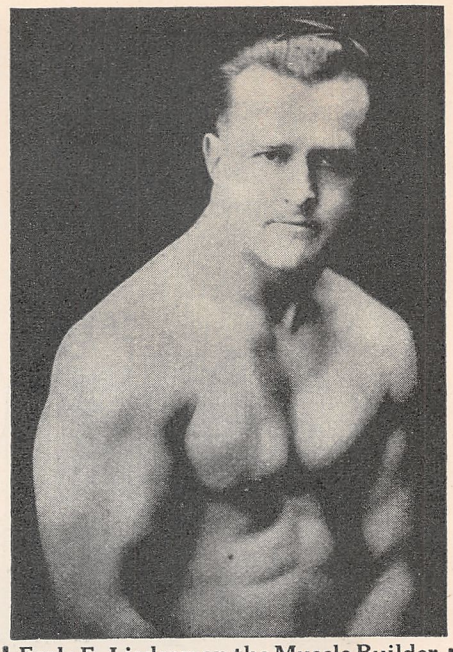
(*Continued from page 337*)

and you will not hurt my feelings, as I have had that said to me before, not to mention the "qrt." Well, let's go.

When I first signed ship's articles as a commercial operator, I had a decided advantage over the majority of men breaking into the game, in that I had behind me several years of sea-going experience. I therefore knew just where I stood, and what to expect from the people I was thrown into contact with. If every operator had the same advantage when starting out, I believe it would be a great help to everyone in the profession, for the reason that it is not at all uncommon for unprincipled captains and other officers to get away with "murder," so to speak, in their treatment of operators new to the conditions on shipboard. Of course, if they are allowed to get away with it in one case they try it on the next operator. I read a letter written to RADIO NEWS a few issues ago, by a sea captain, who said, if I remember correctly, that "Sparks" had so much idle time on his hands that he employed it in thinking up grievances that existed only in his imagination, or words to that effect.

In order that I may not be accused of letting my imagination run away with my better judgment, I will say that by a captain getting away with "murder" in his treatment of an operator I mean those cases which are by no means rare, and sometimes sanctioned by the steamship company (as though the steamship company had a right to do so). For instance, where an operator is expected to do extra work, not connected in any way with radio operating, and without extra pay, such as checking special cargo, making up payrolls, acting as ship's mail carrier, etc. Less than two months ago I was offered a job as operator at a fish cannery land station up in Alaska, wages to be $110 per month, very little radio traffic to handle, but when not sending or receiving messages I was to check fish. About the same time I was offered a job on a lumber schooner as radio operator at $110 per month, with the stipulation that I should shine the brass work in the wheel house. I could give many other instances of trying to get away with such treatment of operators, but will not do so here, as RADIO NEWS is read by sea captains, as well as other people, and some few of them, who try to live up to the "Sea Wolf" type, might consider such instances as good ideas to be tried out next voyage.

Now and again it happens that an operator on shipboard has to contend with a brother officer suffering with the old, and hard to cure, disease commonly called "swelled head." A victim of this complaint never fails to assure an operator that he, the operator, is not an officer, but is only a petty officer. The reason usually given is that it has been known for a captain to order an operator to take his meals with the petty officers. (The petty officers are the boatswain, ship's carpenter, watertenders, etc.) It is bad policy to allow anyone to get away with that idea because if he gets away with it, the next day will see him in the radio room ordering the operator to charge his batteries. It is of course also very petty to argue long about it. Getting down to brass tacks, a mate is a mate because he holds a license issued by the United States Department of Commerce, and an operator is an operator because he also holds a license issued by the United States Department of Commerce. I guess that settles that. If an operator just breaking into the game remembers that aboard ship there are four depart-



Earle E. Liederman the Muscle Builder

If You Were Dying To-night

and I offered you something that would give you ten years more to live, would you take it? You'd grab it. Well, fellows, I've got it, but don't wait till you're dying or it won't do you a bit of good. It will then be too late. Right now is the time. To-morrow or any day, some disease will get you and if you have not equipped yourself to fight it off, you're gone. I don't claim to cure disease. I am not a medical doctor, but I'll put you in such condition that the doctor will starve to death waiting for you to take sick. Can you imagine a mosquito trying to bite a brick wall? A fine chance.

A Re-built Man

I like to get the weak ones. I delight in getting hold of a man who has been turned down as hopeless by others. It's easy enough to finish a task that's more than half done. But give me the weak, sickly chap and watch him grow stronger. That's what I like. It's fun to me because I know I can do it and I like to give the other fellow the laugh. I don't just give you a veneer of muscle that looks good to others. I work on you both inside and out. I not only put big, massive arms and legs on you, but I build up those inner muscles that surround your vital organs. The kind that give you real pep and energy, the kind that fire you with ambition and the courage to tackle anything set before you.

All I Ask Is Ninety Days

Who says it takes years to get in shape? Show me the man who makes any such claims and I'll make him eat his words. I'll put one full inch on your arm in just 30 days. Yes, and two full inches on your chest in the same length of time. Meanwhile, I'm putting life and pep into your old back-bone. And from then on, just watch 'em grow. At the end of thirty days you won't know yourself. Your whole body will take on an entirely different appearance. But you've only started. Now comes the real works. I've only built my foundation. I want just 60 days more (90 in all) and you'll make those friends of yours who think they're strong look like something the cat dragged in.

A Real Man

When I'm through with you, you're a real man. The kind that can prove it. You will be able to do things that you had thought impossible. And the beauty of it is you keep on going. Your deep full chest breathes in rich pure air, stimulating your blood and making you just bubble over with vim and vitality. Your huge, square shoulders and your massive muscular arms have that craving for the exercise of a regular he man. You have the flash to your eye and the pep to your step that will make you admired and sought after in both the business and social world.

This is no idle prattle, fellows. If you doubt me, make me prove it. Go ahead. I like it. I have already done this for thousands of others and my records are unchallenged. What I have done for them I will do for you. Come then, for time flies and every day counts. Let this very day be the beginning of new life to you.

Send for My New 64-Page Book

"Muscular Development"

IT IS FREE!

It contains forty-three full page photographs of myself and some of the many prize-winning pupils I have trained. Some of these came to me as pitiful weaklings, imploring me to help them. Look them over now and you will marvel at their present physiques. This book will prove an impetus and a real inspiration to you. It will thrill you through and through. All I ask is 10 cents to cover the cost of wrapping and mailing and it is yours to keep. This will not obligate you at all, but for the sake of your future health and happiness, do not put it off. Send today—right now, before you turn this page.

EARLE E. LIEDERMAN
Dept. 3609 305 Broadway New York City

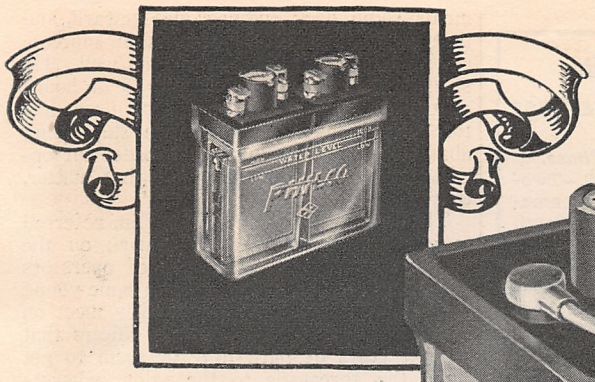
EARLE E. LIEDERMAN
Dept. 3609, 305 Broadway New York City

Dear Sir:—I enclose herewith 10 cents, for which you are to send me, without any obligation on my part whatever, a copy of your latest book, "Muscular Development." (Please write or print plainly.)

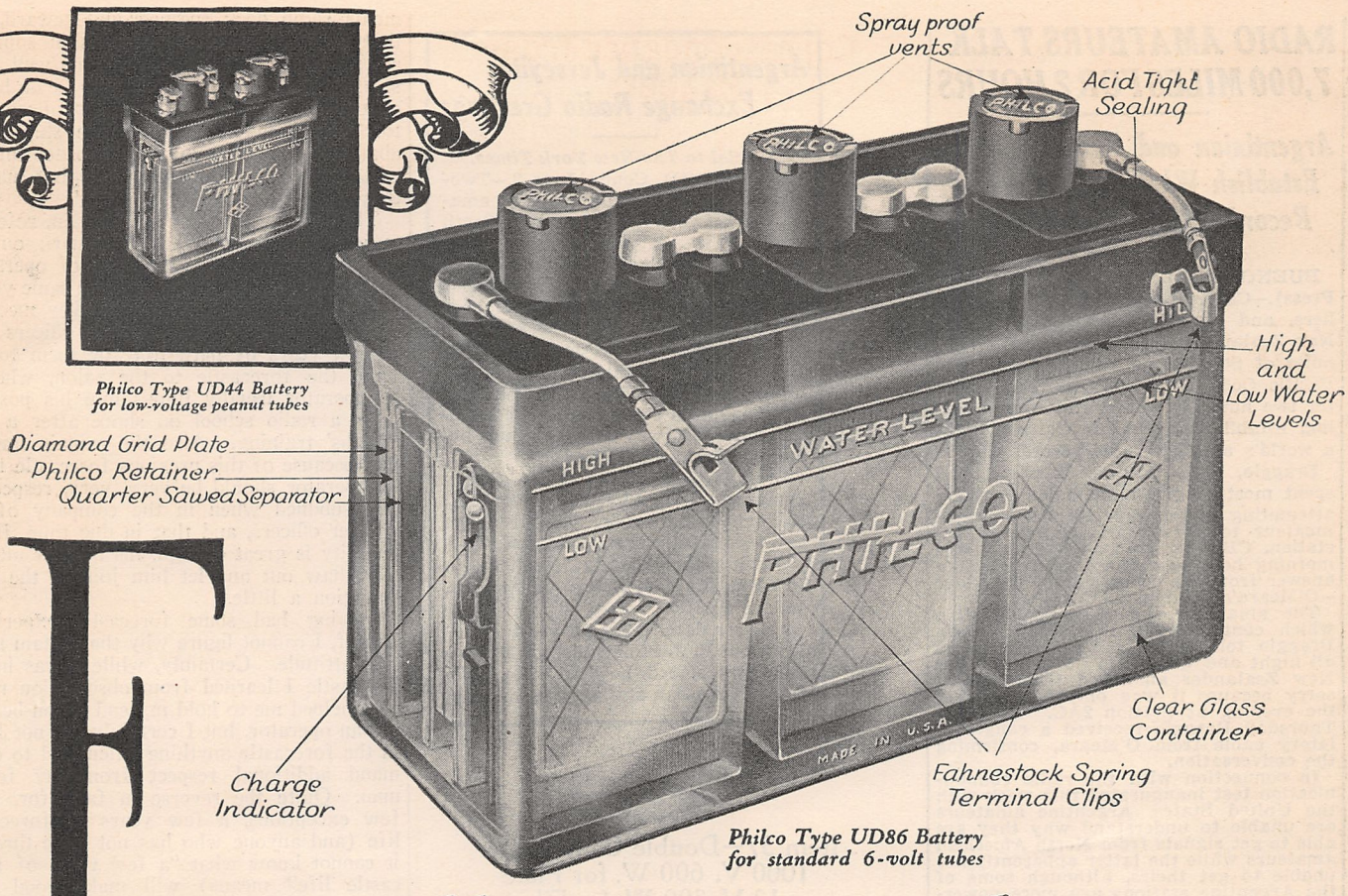
Name .....

Street .....

City ..... State.....



Philco Type UD44 Battery for low-voltage peanut tubes



Philco Type UD86 Battery for standard 6-volt tubes

Forget all you ever knew about radio batteries

No more need of big, cumbersome batteries in the cellar for satisfactory, long-distance radio reception.

The new Philco Rechargeable Radio Batteries—assembled in small, attractive, acid-tight GLASS cases—are absolutely safe for use anywhere in your home.

No more need of guess-work charging or using a sloppy old-fashioned hydrometer. The exclusive built-in Philco Charge Indicator tells you all conditions of charge and discharge.

Philco Batteries are Drynamic—shipped DRY charged. Their life starts when YOU pour in the electrolyte—not months earlier at the factory.

Equally important—Philco Batteries deliver a strong, uniform current over long periods. This means great amplifying power—noiseless service—no frequent, troublesome adjustments.

Philco Chargers make recharging so easy, simple and safe a child can do it. Just a throw of a switch—or a plug in a socket. No odor—no noise—no danger of overcharging.

See them at your nearest Philco Service Station, Radio or Music Dealer's, or fill out the coupon below and mail to us.

PRICES

Philco Type UD86 Battery for standard 6-volt tubes. Guaranteed 2 years $16.00*

Philco Type UD44 Battery for low-voltage peanut tubes. Guaranteed 2 years $8.00*

* *East of the Mississippi River*

The Philadelphia Storage Battery Company, *Philadelphia*

PHILCO DRYNAMIC RADIO BATTERIES

REG. U.S. PAT. OFF.

Philadelphia Storage Battery Co.
Ontario & C Sts., Philadelphia

SIRS:—I am interested in learning more about the new Philco Rechargeable Storage Batteries for radio.

Name _____

City _____ State _____

Name of Radio Set _____

If you are a dealer in radio, please state _____

RADIO AMATEURS TALK 7,000 MILES FOR 2 HOURS

Argentinian and New Zealander Establish What Is Declared a Record for Non-Professionals.

BUENOS AIRES, May 24 (Associated Press).—Carlos Braggio of Bernal, near here, and Ivan O'Meara of Gisborne, New Zealand, radio amateurs with 7,000 miles of South American continent and Pacific Ocean between them, conversed for two hours by radio Thursday morning, establishing what is claimed to be a world's amateur radio record.

Braggio, who knows English, had spent most of the night unsuccessfully attempting to get some North American amateur to answer the signals of his station, CBZ8, when at 4 o'clock in the morning he was amazed to receive an answer from the other side of the globe—O'Meara's station, 2AC.

The amateurs opened a conversation which continued until 6 o'clock, when Braggio told O'Meara he had been up all night and wanted to go to bed. The New Zealander answered that he was sorry because it was only 9 o'clock in the evening at Station 2AC. Later on Thursday, Braggio received a congratulatory cable from O'Meara, confirming the conversation.

In connection with the radio communication test inaugurated this week with the United States, Argentine amateurs are unable to understand why they are able to get signals from North American amateurs while the latter apparently are unable to get theirs, although some of the Argentine stations are more powerful than some of the American ones which have been heard.

It is believed that many of the powerful broadcasting stations operating in the United States nightly interfere with the Argentine waves. In the future Braggio will try sending on a 120 meter wave-length at 3 A. M., Eastern Standard Time.

Argentinian and Jerseyite Exchange Radio Greetings

Special to The New York Times.

HARTFORD, Conn., June 2.—Two-way radio communication by amateurs between North and South America was attained for the first time last week by Norman R. Weible of Collingwood, N. J., and Carlos Braggio of Bernal, suburb of Buenos Aires. The feat was checked and verified today by the American Radio Relay League of this city, which tonight announced that Weible and Braggio had a twenty-minute connection on short wave lengths just before daybreak last Friday.

Braggio heard the New Jersey amateur calling him, and at 4:15 A. M. sent the following: "GM greetings and congratulations QRZ QRK."

Weible immediately replied in Spanish, "Saludo, Amigo de America del sur QRK."

A letter dated May 21, received today from E. J. Simmonds, an English amateur, stated he had heard the South American station transmitting.

Mr. Braggio Used

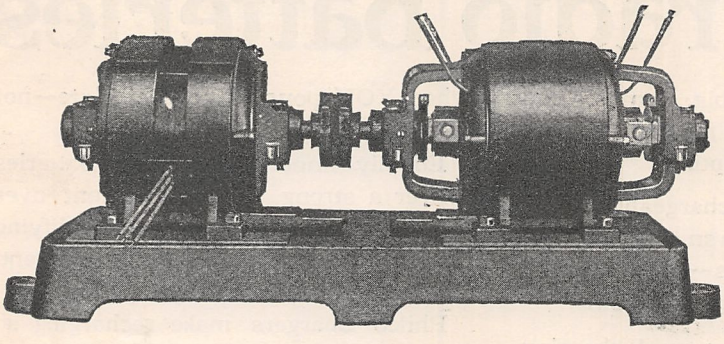
"ESCO"

Item 37—Double Commutator
1000 V. 600 W. for Plate
12 V. 300 W. for Filament

He writes:

"If I have the luck to be heard in the U. S. a great part of the success will be due to the good capacity of the "ESCO" set."

This is Item 37, used by CBZ8



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RADAK

RELIABLE RECEIVING SETS

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107 Main St. Cambridge, Mass.

UNITY VERNIER RHEOSTAT

The Highest Type Instrument Made

Any Resistance $2.00

"Hear a Set That Uses One"

ELIMINATE THE NOISES IN YOUR SET

The book **"TUBE CONTROL,"** written for the amateur, and for the benefit of Radio Reception, by J. Elliott Jenkins, **Engineer of Broadcasting Station W. D. A. P.** will tell you how to clear up your signals.

Every set owner should have this book.

10c at your dealers, or 14c postage to **UNITY MFG. CO., 224 N. Halsted St., Chicago**

NEW YORK OFFICE, 50 Church Street

ments, radio, deck, engineer and steward, and that the captain of the ship is in supreme command over all four, he will do well. He should not take orders from anyone on board except the captain and the chief radio operator, except in the case of the ship being abandoned, when a mate may order an operator, or a chief engineer for that matter, to go to his life boat.

The letter written by the captain, referred to above, also contained a remark on the extreme youth of the majority of operators whom he has met, and how these same young men ought to remember when they meet on terms of equality with brother officers that it took years of hard toil for them to get from the forecastle to the salon, whereas an operator usually jumps into his position from a radio school on shore after a few months' training. Also the captain implied that because of this previous forecastle fight, an operator should be very, very, respectful and subdued when in the company of his brother officers, and that in due time, if his humility is great enough, his brother officers will thaw out and let him join in the conversation a little.

Having had some forecastle experience myself, I cannot figure why the captain takes that attitude. Certainly, while I was in the forecastle I learned from observation much that helped me to hold my end up on becoming an operator, but I certainly did not learn in the forecastle anything calculated to command additional respect from my fellow man. Quite the reverse in fact, for, with few exceptions, a few years of forecastle life (and anyone who has not gone through it cannot know what "a few years of forecastle life" means) will make good men bad, and bad men worse, morally, and in most other ways. Any man who has been to sea any length of time will admit the truth of this statement (except when he is talking to his folks).

Also I would like to remark that it does not seem to me to be very sensible to treat a person as an inferior because he happens to be younger by a few years than yourself. A man's words and actions mirror his mind and character. I judge a man by his words and actions, therefore, and not by his years.

If the radio schools up and down the country were to include in their courses some dope on conditions prevailing on shipboard, and point out to operators various pitfalls and how to avoid them, in my opinion it would do the game lots of good.

During the time I have been going to sea I have encountered relatively few cases of the "try to get away with murder" spirit spoken of in the letter I have commented on. I believe it depends greatly upon the operator himself. If he is easy, someone will try to ride him. I have met but few bad captains, and with my brother officers have in the great majority of cases been treated with the same consideration and respect that it has always been my endeavor to show them.

In the future I shall be glad to write to "With the Sea Going Ops" department if this finds favor, and will be glad to see comments on my letter, adverse or otherwise, from other commercial operators, but I hope no sea captain will write and tell me I am not humble enough. HI!

J. MARTIN, Opr.,
S.S. *La Purisima.*

AMATEURS HELP LAKE SHIPS

Editor, RADIO NEWS:

Referring to the editor's note regarding the "Sea Going Ops" column in your magazine telling of the lack of material with which to keep that department going, I have some news which may interest amateur and commercial operators alike.

At the present time I am operator on a

Your dealer has something really new and unusual

MAGNAVOX M4

CALL at your dealer's today and ask him to show you a Magnavox M4 Reproducer.

Try out the instrument critically; satisfy yourself that its clear tone and natural volume are sustained throughout the entire musical range; examine each essential detail of convenient size, handsome finish and sturdy construction; note that its operation requires no battery.

M4 is a definite contribution to the radio art—and one particularly welcome to the moderate income.

There is a Magnavox for every receiving set

Reproducers

M4—the latest Magnavox achievement: requires no battery . . $25.00

M1—also constructed on the semi-dynamic principle, requiring no battery $30.00

*R3—famous electro-dynamic type: new model with Volume Control . $35.00

R2—same as R3 but larger size: new model with Volume Control. . $50.00

Combination Sets

A1-R and A2-R—the only instruments combining electro-dynamic Reproducer and Power Amplifier in one unit $59.00, $85.00

Power Amplifiers

A1, AC-2-C, AC-3-C—the most efficient audio-frequency Amplifiers: one, two & three stage $27.50 to $60.00

To obtain the fullest enjoyment from your receiving set, equip it with the Magnavox—for sale at good dealers everywhere.

THE MAGNAVOX CO.
OAKLAND, CALIFORNIA
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M4
$25.00

APPROVED RADIO NEWS LABORATORY 1922

MAGNAVOX Radio

MAGNAVOX

THE drum of the African savage—the smoke signals of the American Indian—the signal fires of Troy—all contributed to blazing the trail for that modern wonder Radio.

The extremely delicate forces employed in Radio make necessary the use of the finest of apparatus for your full enjoyment.

Holtzer-Cabot Loud Speakers, Phonograph Attachments and Headphones are the perfected results of thirty-five years' experience in the manufacture of delicate electrical apparatus.

Your reception will be improved through the use of Holtzer-Cabot apparatus. A trial is to be convinced.

Holtzer-Cabot Loud Speaker $25.00
Loud Speaker Phonograph Attachment 10.00
No. 2 Universal Headphones 9.50
No. 4 National Headphones 6.00

Write for booklets explaining how the exclusive features of these instruments enable you to enjoy the wonders of Radio

THE HOLTZER-CABOT ELECTRIC CO.
125 Amory Street, Boston, Mass.
6161-65 South State Street, Chicago, Ill.
Dept. D1

Holtzer-Cabot
BUSINESS ESTABLISHED 1875

Jones MULTI-PLUG and Cable

Standard equipment on Zenith for over one year.

Will be standard equipment on twenty-five of the leading sets this fall. Watch for their names.

Ask your dealer and manufacturers to put this trouble and tube saver on your set.

Plugs in all Input Connections.

For sale by your Jobber

HOWARD B. JONES
612 S. Canal St. Chicago, Ill.

AMPLION The World's Standard Loud Speaker

I have made $900 in ONE MONTH

says Frank DePries, one of our live wire representatives. L.D. Payne averaged $20.77 profit per day for 217 days. Slidell and Viles sold over $25,000 in 2 years. G. Howard earned $100 in one day. F. E. Mendenhall worked half time and made $100 a week. W. E. Findlay ran up his commissions in a few months from $100 to over $500 per month. Every Home, Auto Owner, Store and Factory a Live Prospect—Keeton, Howard, and others, never sold Fire Extinguishers before. Our special training course starts you on road to success first day. If now employed, we can show you how to make big money during spare time. No Experience Necessary. Get our new Sales Plan. Territory going fast—write today!

Approved by Underwriters

Any MAN can sell them

THE FYR-FYTER CO., 295 Fyr-Fyter Bldg., Dayton, O.

WALNART "TROUBLE-PROOF" RADIO PRODUCTS

Great Lakes bulk carrier vessel, this season being my third on the Lakes.

The navigation on the Great Lakes is only for eight months of the year, as ice blocks traffic the other four months.

We started our season on this vessel April 19, on which day we cleared Buffalo, N. Y., for Superior, Wis. (which is at the extreme end of Lake Superior), with a cargo of coal. We were delayed three days by fog in the rivers and finally reached Duluth Harbor. On arriving there, a heavy northeast gale blew the loose ice packs into a solid mass outside of the harbor for three miles, through which it was impossible to work as the ice in places was 30 feet thick.

The masters of the vessels were naturally anxious to advise the ship owners as to conditions. By this time there were about 30 vessels ice bound. Sixteen were equipped with apparatus. We were trying to get into communication with the nearest land station, at Port Arthur, Ontario, Canada, but owing to some defect in the receiving apparatus, the operator there was unable to hear us. At this time the amateurs in Duluth took a hand, and hearing we were stuck in the ice, offered to take messages to the ship owners through the local Western Union office. We were stalled in the ice for three days and the skippers were very angry at us for not being able to raise a station 125 miles away. I wish to thank station 9DOE for helping me to get my traffic off through him.

JULIUS KATONA,
S.S. *Clemens A. Reiss*,
Marine P. O.,
Detroit, Mich.

CONCERNING RADIO TERMS

Editor, RADIO NEWS:

Suggestions from readers are welcomed, I believe, by the editors of almost every magazine, especially RADIO NEWS. If they are absurd, they can easily be consigned to the waste paper basket and no harm done. On the other hand, they may be the means of benefitting hundreds of readers.

There are many things of interest which amateurs would like to see published, and if a current issue contains something they are really anxious to read, there is a feeling that RADIO NEWS is a fine paper.

But how often do we see a person glance through the pages when desiring information on some specific subject, throw it aside in disgust with a comment such as "Nothing of interest in this month, getting like the rest of them," simply because it did not contain some point uppermost in his mind at that time. I do not wish to imply that many readers do this, but I have seen it done. I'll admit I have done that very thing myself when feeling a little off color, but later have picked up the same issue and found several articles of great value. In fact, since I started reading RADIO NEWS, about two years ago, I have always found at least one article alone worth much more to me than the purchase price of the magazine, and the advertisements are always of interest.

Our writing to the editor occasionally, and stating just what we wish to know, not only enables him to get a clearer conception of what is in demand, but we also help ourselves by helping others, hence my reason for asking the following question: Is radio an exact science? Oh, yes! sure! Then why are we so careless in our terminology? Are we doing anything to eliminate the confusion, especially to the beginner, that is caused by our loose use of words? And does not this confusion often lead to disgust and loss of interest with the oft-repeated phrase, "Radio is too deep for me."

Would not radio get a tremendous boost

The Radio Sensation!

The new American Brand Worm Drive Vernier Condenser, with a *hundred* to *one* ratio Worm Drive geared vernier adjustment.

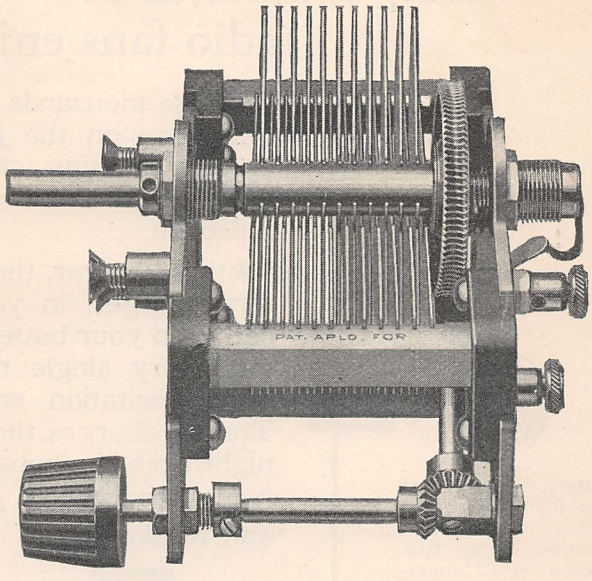
This is the highest ratio gear adjustment ever developed on Variable Condensers. With this adjustment the plates may be moved so slowly that the motion is hardly noticed by the eye.

A remarkable micrometer adjustment of the entire set of movable plates can be obtained. This wonderful achievement is of special importance to the radio fan seeking distant stations.

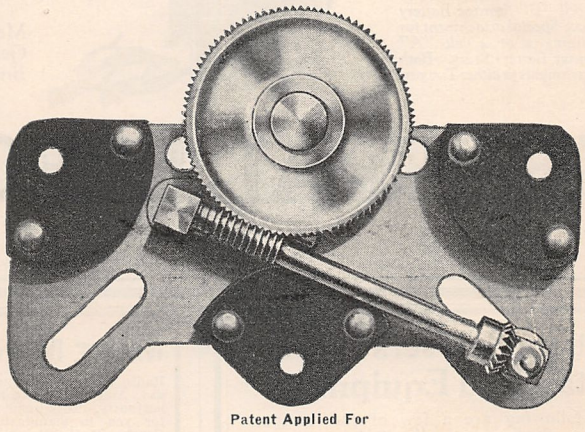
Another tremendous exclusive feature—the back panel of American Brand Condensers is adapted for the mounting of any coil desired for use in the set. A. B. Condensers are made from finest heavy brass. The plates are perfectly flat and will never get out of line. Plates and supports are in natural finish, keeping radio frequency losses at a minimum. Mechanically and electrically a perfect job.

And the price of this Super Brass Plate A. B. Condenser with Worm Drive Vernier (23 *Plates* .0005 *mfd.*) *is only* $5.00. 13, 17 *and* 44 *plates with or without Worm Drive Vernier at proportionate prices.*

Please ask your dealer to show you this wonderful condenser. If he can't do so, write us for descriptive illustrated folder—and send us your dealer's name.



The 100 to 1 WORM DRIVE



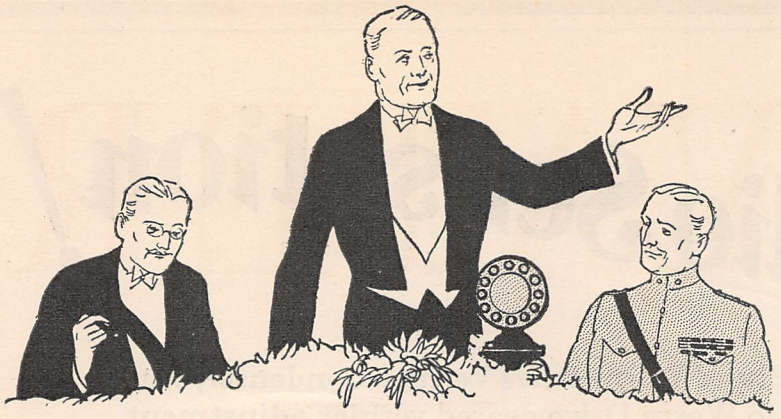
Patent Applied For

Note to Dealers:—If your Jobber can't supply you with A. B. Condensers write us.

AMERICAN BRAND CORPORATION

8 WEST PARK STREET, NEWARK, N. J.

FACTORY—PHILADELPHIA



Why thousands of radio fans enjoy him

Because thousands of storage batteries are on the job, brimful of energy, gaining clear, satisfying radio reception for every word and inflection.

With a Tungar, the carefree battery charger, in your home you can keep your battery tuned up to get every single note of music, every recitation, speech or song. Tungar charges the battery overnight from the house current.

Sold by Electrical, Auto-accessory and Radio dealers.

Tungar is one of the many scientific achievements contributed by the G-E Research Laboratories toward the wonderful development of electricity in America.

Tungar Battery Charger operates on Alternating Current. Prices, east of the Rockies (60 cycle Outfits)—2 ampere complete, $18.00; 5 ampere complete, $28.00. Special attachment for charging 12 or 24 cell "B" Storage Battery $3.00. Special attachment for charging 2 or 4 volt "A" Storage Battery $1.25. Both attachments fit either Tungar.

Tungar
REG. U.S. PAT. OFF.
BATTERY CHARGER

Tungar—a registered trade mark—is found only on the genuine. Look for it on the name plate.

Merchandise Department
General Electric Company
Bridgeport, Connecticut

GENERAL ELECTRIC

43 E-10

Satisfied Users Prefer Standard Equipment

The following are a few of the companies for which we are distributors:

Zenith Sets (Regenerative)
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Remler Material
Grebe sets (Regenerative)
Murdock Sets (Neutrodyne)
General Radio

Send stamp for Catalogue 45-R

J. H. BUNNELL & CO.
32 PARK PLACE NEW YORK

MAKE MONEY—SELL RADIO

Radio offers the biggest money-making opportunity today. And the **Ozarka Plan** opens the door to this big opportunity. This wonderful plan makes it easy and simple for you to manufacture the beautiful, long distance Ozarka Radio Receiving Set. It will be **your Radio.** made by you and sold by you, with a big cash profit as your reward.

No experience necessary. You need not have much cash. All you need is spare time, determination and action. If you're that kind of a chap, the Ozarka Plan will start you on a straight line toward a real money-making business of your own. It can be as big and as profitable as you are ambitious to make it. We want good men in every county. Exclusive territory is going fast. Be sure and give us the name of your county. Write today for the Ozarka Plan. A wonderfully interesting book of facts, particulars and proofs. It is FREE. Act now.

OZARKA, Inc.
63 N. PEORIA ST., CHICAGO

Insure your copy reaching you each month. Subscribe to Radio News—$2.50 a year. Experimenter Publishing Co., 53 Park Place, N. Y. C.

if all used correct nomenclature and stuck to it? Is there any science or industry that can compare with radio for inexact terminology which causes such confusion to the tyro?

Take, for instance, the automobile industry with its many different makes of cars. We always refer to the separate parts by given names, whatever the make, design or shape of the article, as the radiator, engine, transmission, etc. Then why not in radio? Just walk through the stores, look into several radio sets and what do you invariably find? The same circuit by different manufacturers; then observe the difference in the names given to the various dials. A dial used for the same purpose on each set will in all probability have as many different names as there are sets. Neither can it be said truthfully that those different names are synonyms, for if we eliminate the majority we are a long way from being guilty of that unpardonable offense, tautology. Each name is correct to a certain extent, but the confusion retards interest.

We do not hear people refer to the radiator of an automobile as the water-cooler, the heat dissipator, or the thermohydro temperature reducer, yet to the radio amateur we have something equally perplexing.

In an endeavor to decide which will be the most efficient and most satisfactory receiving set to make for next winter at a minimum cost, I have before me 100 or more diagrams of receiving sets. They have attached to them all kinds of names, mono, auto, plex, dyne, etc., yet when traced out they seem to me to be all derived from three or four standard circuits. The pages you are now giving to "Standard Hook-ups" I feel sure will be appreciated by many, as their careful study will be a great help.

I would like to see published a few articles on "Correct Radio Terms," and when and how to use them and whether we use valves, bulbs, or tubes in our sets, etc. For if radio is an exact science, should we not use exacting nomenclature?

F. L. L.

BRITISH 2LZ ANSWERS 5XZ

Editor, RADIO NEWS:

I have just read the letter from British 5XZ in the June issue of the RADIO NEWS. Being an old time dyed-in-the-wool British ham I have followed the progress of amateur radio very keenly since the war (and considerably before it, for that matter). I think 5XZ is—what you Americans would say—"talking through his hat." I am afraid his attempt at "talking" American is a very poor one. He seems very keen on your spending a holiday over here, to see how we do it. Perhaps he will be good enough to act as host when you arrive. Apparently he has no fear of your coming, as I am afraid he would be rather "let down" if he wished to give you a demonstration of how to receive DX broadcast in this part of England; and I don't think he is quite so advantageously situated as I am.

I should like to hear anyone in London receive any other B.B.C. station than 2LO on a loud speaker with sufficient volume, clearness and freedom from interference as to be able to sit down and listen to for a whole evening with comfort. No! Mr. American, believe me, it can't be done here. Our station is 2LO. If we don't like 2LO's program we can switch on to another B.B.C. station, and, if we are lucky, get snatches of a program, plus harmonics from the high power stations and the "boiler repairers" (as you call them).

5XZ does not appear to know that the power input of the B.B.C. stations is 6 K.W., not 1 K.W. And what is more we are going to have a station of 25 K.W.

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There is no doubt about it, you Americans are ahead of us every time with amateur radio, and I think every British ham will admit it but we soon catch you up, don't we? 5XZ suggests that some of your circuits are quite old; admitted, someone is always bringing out a new circuit which, when it is unscrambled is some old "standby." You are not the only offenders, I can assure you. What about the British radio journals? One thing, you do put out some good dope at times. The Ultradyne is one; I have one, and many thanks and congratulations for it.

5XZ asks when you are going to pick us up and re-broadcast to U. S. A. Easy. When we fix up a high power short wave station to enable you to do it. 'Nuff sed. He also does not seem keen on having more than one broadcast station in London. Personally I should like several, so that we could have a good selection of programs to choose from. Perhaps 5XZ's receiver is not selective enough. I have no fear on this point myself. I often carry out DX work with French and British amateurs during broadcasting, transmitting and receiving, while the rest of the family are listening to the broadcast from London, and cause no interference with the reception of London's program, although the receiver is within 6 feet of the transmitter. I could not do this without the American Ultradyne. I wonder if 5XZ has ever heard 2LO being re-radiated on short wave, not knowing where it was coming from. I could tell him.

As a final remark, I must mention one thing you can do, which appears to have escaped the notice of 5XZ. You CAN put out a real live radio paper, and that's a good deal more than any of our publishers over here can do.

There are two pieces of American radio literature I look forward to every month, and they are RADIO NEWS and "Q. S. T." and I DO enjoy them.

F. A. MAYER,
British, 2LZ,
Stileman's Works,
Wickford, Essex.

AN ANSWER TO 5XZ

Editor, RADIO NEWS:

I quote from the letter of British 5XZ: "As for bootleg stations, we don't have 'em. Also, we certainly do have pirates who do not pay the receiver tax." If 5XZ prefers to call them "Pirate Stations" it is but a matter of his choice of words. However, since a certain day in July several years back, Americans have been applying the word "bootleg" to anything which is illicit.

I agree with 5XZ that American amateurs are not confined to a single wavelength, as are those in England. I'll wager that there is not an amateur in the United States who would want his transmitter "tuned dead on his allotted wave." The American amateur prefers to change both his transmitter and his wave-length; he prefers to experiment. Remember, 5XZ, that the amateur was the first to use the shorter wave-lengths, which make it possible for the British stations to re-broadcast the programs of station KDKA.

Undoubtedly 5XZ does enjoy the programs of his local stations more than the ones he hears from American broadcasters. Maybe the programs from this side lose some of their clarity and volume in crossing the Atlantic.

You ask when we are going to re-broadcast your stuff as the B.B.C. does ours. There is but one answer to that question—when you get your stuff across. The programs of KDKA, which are re-broadcast by the British stations, are also re-broadcast by stations KFKX, Hastings, Neb-

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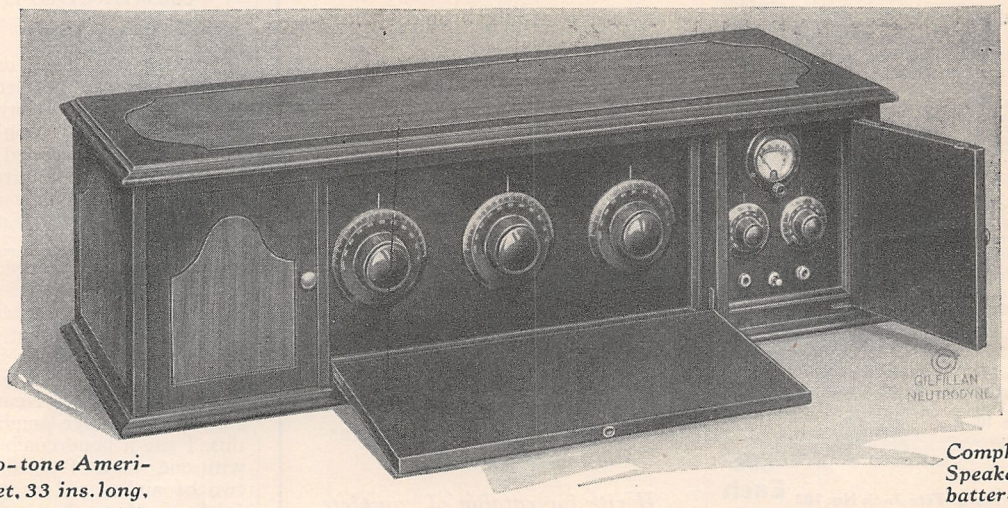

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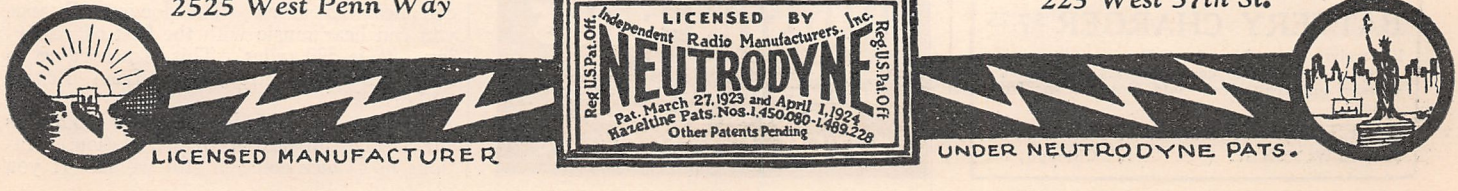

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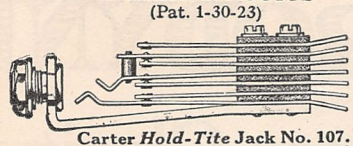

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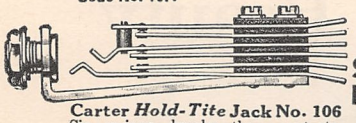

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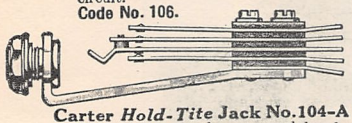

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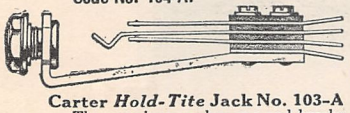

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raska, and KGO, Oakland, California. You see, we can re-broadcast. The engineers of the British Broadcasting Co. have my hearty congratulations on re-broadcasting our stuff, but you must admit that our engineers deserve a little credit for getting their stuff over.

As for DX in America, Hastings, Nebraska, Chicago, Illinois, and Atlanta, Georgia, will each operate a loud speaker through a three-tube set any night at all in Baltimore. I believe these distances are a little greater than that between Aberdeen and London.

I am sorry that you have such a misconception of conditions relative to broadcasting in America. I have hopes that the foreign broadcast stations will soon stop saving power and let us hear from them without having to use a 10-tube super-heterodyne.

JAMES NITRE,
Baltimore, Maryland.

A COMMERCIAL OP'S VIEWPOINT

Editor, RADIO NEWS:

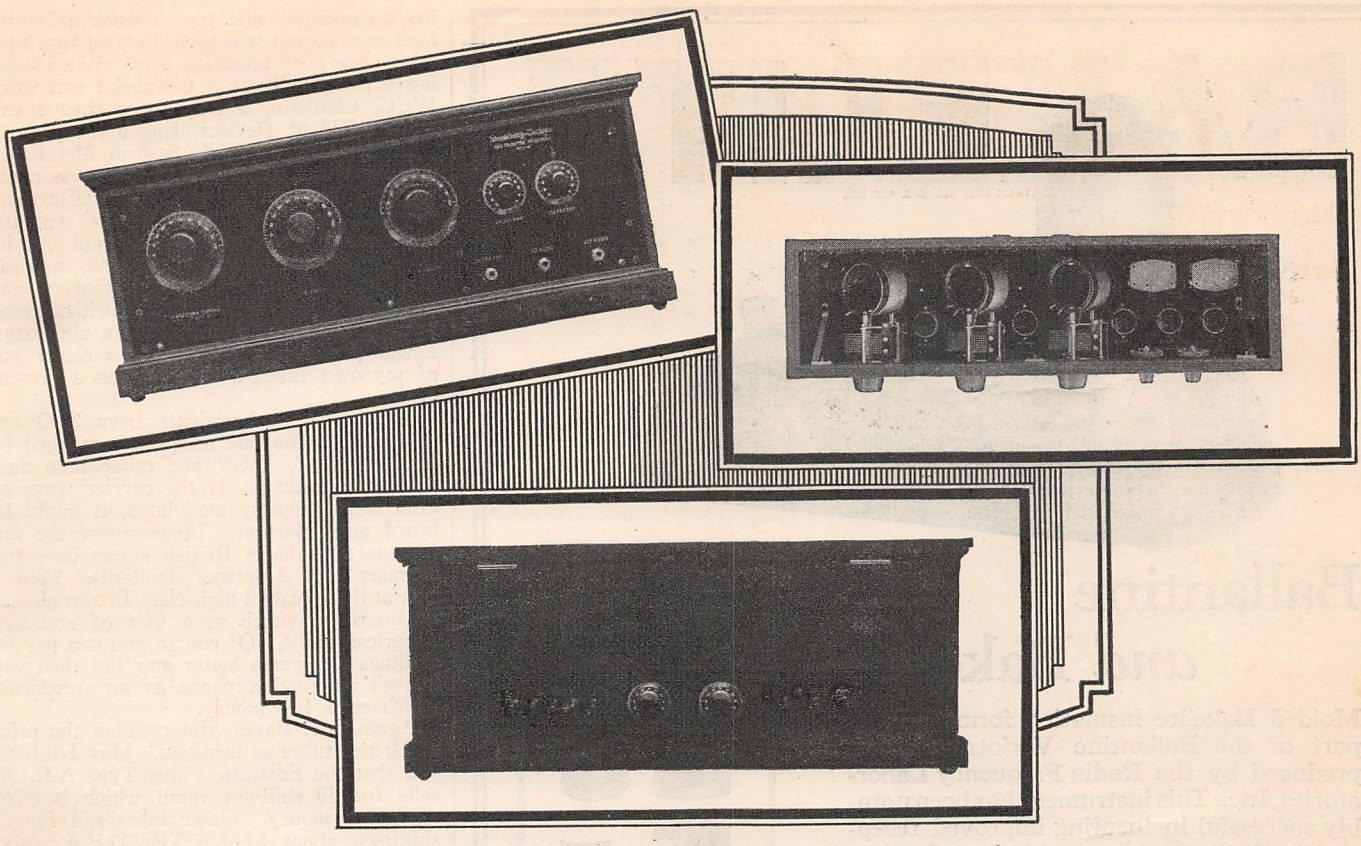
Just opened the June issue of RADIO NEWS and read the letter written to your paper by A. F. C. Bayes, British 5XZ, 48 Lavender Gardens, England, London S. W.

This letter interested me very much because I have made three trips to England during the last winter and had a good opportunity to listen to English broadcast programs as sent out by 2LO of London, and some of the other broadcast stations of the B.B.C. I am wireless operator on S.S. *Emidio* running between Los Angeles and London and Southampton. I am using various types of receiving apparatus which include an S.E. 1420 U. S. Navy type receiver which embodies the Neutrodyne principle and a Grebe two-stage amplifier. In addition to this, I use a honeycomb coil regenerative set with one stage of tuned radio frequency and two of audio, and as you can imagine get fairly good results.

Mr. Bayes seems just a little peeved about America for some reason which he fails to mention. It may perhaps be because he can hear American stations in England better than he can hear the British stations there. I have no difficulty in getting fair results on good nights in listening to American stations 1,500 to 2,000 miles, but the farthest I was ever able to hear 2LO was 1,400 nautical miles and the reception was very bad, not clear and hardly audible. Other B.B.C. stations come in still worse.

I went into a radio store at Southampton where many types of ready-made receivers were on sale. The manager requested me to listen to some broadcasting. It was 4 p. m., and the set had two tubes. I put the phones on my head and could faintly hear music coming from somewhere, which I figured must be coming from a very long distance. I asked the manager how many hundred miles away the station was located. He smiled and said it was located 23 miles away. I also purchase all the radio magazines on sale at newsstands and in these columns you can plainly see what the average range of a British set is. Please read page 717 of No. 8 issue of Harmsworth Wireless Encyclopedia under "Distance of Reception" and you will find that one valve will enable you to hear music the enormous distance of 25 miles, and by adding one stage of high frequency amplification you can hear 75 miles. The longest distance you can hear music with the best of receiving sets is 520 miles. This is according to latest authentic information from British authorities.

As a matter of fact, this is about as far as one can hear a British station. Stations in France come in still worse. If you



The photographs show the Formica front panel, Formica base panel and Formica back panel used in the Stromberg-Carlson Neutrodyne set

For more distance and more volume, Use more Formica!

DESIGNERS and builders of sets incorporating radio frequency amplification — neutrodyne, super-heterodyne, and reflex — have found that the best possible parts will give far less than maximum results unless the greatest care is taken to prevent current leakages.

They are using Formica front panels, Formica baseboards for mounting the instruments, and in some cases Formica back panels for the battery terminals. The remarkable new Stromberg-Carlson Neutrodyne set is an example of what can be accomplished in this way.

There is often a difference that means loud speaker volume on stations that would otherwise come in only on the phones; it means logging new DX stations that would have been impossible before.

Insist on Formica. It won't warp. Binding posts won't loosen up because the material cold flows. The insulating quality is certain and uniform — and the finish the best there is.

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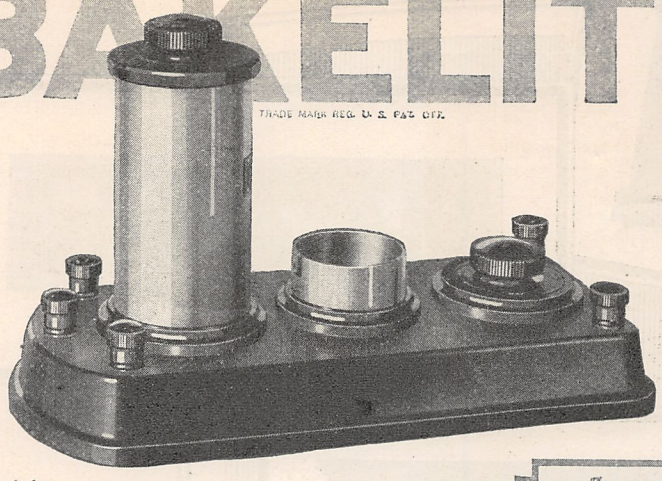
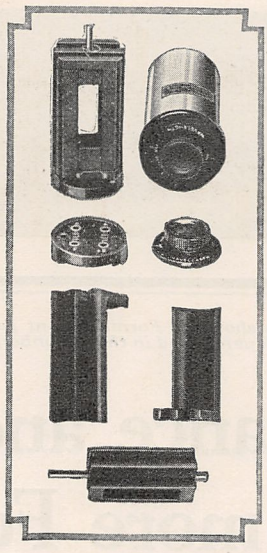


Ballantine *and* Bakelite



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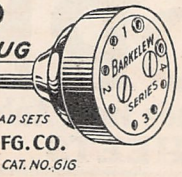

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are an operator and try to work a British land station, you will soon discover that they have very poor receiving sets. When coming out of the English Channel I can work WCC, Chatham, Mass., easier than I can work GKU at Devizes, England.

Incidentally, we might inform Mr. Bayes that American ships do many times as much relaying for British and other European ships as they do for us. I have seen the latest marine radio installation put out by the English Marconi Company and, my dear Mr. Bayes, if you can look at that set and the work it does and say that British apparatus is comparable to American apparatus, I will purchase a good radio receiver out of my own funds and make you a present of it.

The programs broadcast from 2LO are not equal to the fine programs arranged by KDKA, WJZ, WGY and other high-class American stations. If the carrier wave of 2LO were properly modulated, it might be heard much farther. Furthermore the apparatus on sale in British stores does not compare with American standards. Take a look at the so-called high-class Brown phone; they cost as much as a pair of standard American make. Of course you can pay 66 shillings and get a better pair but then you haven't as good a phone as an American, which costs less money.

Again, Mr. Bayes, you mention the price of British tubes as being $2. May I inform you that the Ediswan Valve Type A.R. .06 sells for 30 shillings retail which is $6.60 American money. Other tubes sell for 21 shillings, about $4.62. The D.F.A. valve sells for 30 and 35 shillings, or $6.60 to $7.70. A glance through a British magazine shows that all radio apparatus is just as high in price as American, and is ~~in~~ferior in quality.

Better guess again, Mr. Bayes. There are some Americans who go to England every year and we know what you have over there far better than you know what we have over here. America leads the world in radio development today and you can learn much by studying American methods.

FRED M. HOWE,
Radio Opr. S.S. *Emidio*,
KDTJ Arc Transmitter.
San Pedro, Calif.

ANOTHER LETTER FROM BRITISH 5XZ

Editor, RADIO NEWS:

I am sorry to trouble you again, but shall be glad if you will treat this as a postscript to my previous letter.

I forgot to mention that grave doubts have been cast here as to whether the British Government can enforce the payment of any license fee or tax on radio receivers, since the wording of the Wireless Telegraphy Act makes it quite clear that the Government has control over radio stations transmitting signals only. I think it speaks well for our system that under the circumstances 99 per cent. of the listening public is willing to pay fees and submit to Government control.

On the general matters of which I complained in my letter published in the June issue of RADIO NEWS, I beg to tender my thanks on behalf of myself and all British readers for your article on "Broadcasting" by Dr. Fleming. The article on "Will Future Broadcast Stations Be Buried?" was rather humorous in parts, though, and I am sure Dr. Rogers will be the first to desire to disassociate himself from the extravagant claims made by Mr. Winters. Dr. Rogers did not originate the underground antenna, nor is anything recorded in the article in question of an epoch making nature. Such antennae were fully investigated by a German (Kiebitz) and found to have excellent directional properties and consequently were

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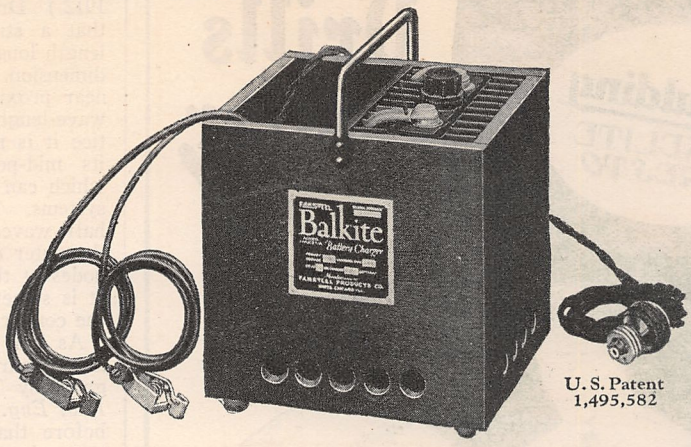

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has gained universal acceptance in less than a season

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This charger is entirely noiseless. It has no bulbs or contact points. It has nothing to adjust, break, replace or get out of order. It cannot deteriorate through use or disuse. It delivers a taper charge. It cannot discharge, short circuit, or damage the battery by overcharging. It needs no attention other than an occasional filling with distilled water. It is unaffected by temperature or fluctuations in line current. It is simple, efficient, cannot fail to operate if properly connected, and is practically indestructible except through abuse.

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Detroit Electric Co., 113 *East Jefferson Street, Detroit*
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—and furthermore, you can depend upon Spaulding Bakelite-Duresto panels as combining in one material these vital qualities—drills without chipping; cuts clean, leaves no ragged edges; engraves easily; retains its natural mirror gloss finish and color; will not sag or warp under weight of mounted instruments; possesses high dielectric properties.

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DEPT. 5

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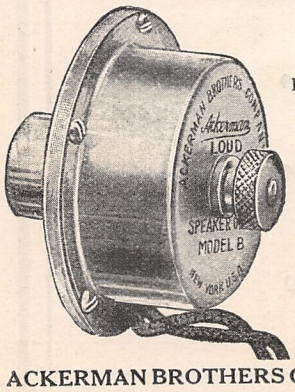
Ask your dealer for Spaulding Bakelite-Duresto. Insist on it and be assured of Spaulding qualities—the fundamentals of good construction and best results.

Ackerman



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$5.00

COMPLETE WITH 5 FOOT CORD

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Spintite

For Round or Hex Nuts

It's great fun to build a radio set with Stevens Spintite Wrenches. They spin up the tough little nuts in a jiffy—*tight as if soldered.*

Set of 3 Round Spintites $1
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Write for Radio Tools Booklet No. 24

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Toolsmiths since 1899

375 Broadway New York

WE BUY FOR CASH! — Entire Stocks

of standard radio merchandise. Write or wire what you have.

CHICAGO RADIO BARGAIN HOUSE

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not suitable for broadcast work, unless for the purpose of feeding relay stations. (See the *Jahrb. d. Drahtlose Telegraphie,* p. 349, 1912, and the *Electrician,* 1 x v iii, p. 868, 1912.) Dr. Rogers has, no doubt, discovered that a straight conductor one-half wavelength long is the most favorable theoretical dimension, allowance being made for the near proximity of the earth shortening the wave-length to about seven-eighths. In practice it is necessary to cut the conductor at its mid-point and insert inductance coils which can be coupled to suitable oscillatory systems. The system then oscillates in two half waves, there being potential loops at the outer ends of the buried conductor and nodes at the outer ends of the inductances. It is sometimes useful to earth the ends of the conductor through condensers.

As to receiving antennae, buried or almost buried wires have been fully investigated by Taylor and Crossley. (See *Inst. Rad. Eng. Proc.* viii, p. 171, 1920.) Long before that, such antennae (consisting of two wires laid out in the traverse bottom of a trench) were used in the ultra short wave trench receivers in the British Army on the western front. It was found that the horizontal line of the wires must pass through the transmitting station for best results.

As to the article in the May issue of RADIO NEWS, on "Radio Beacons," by Dunmore, I think you should have mentioned that the system of using two crossed loops and signaling "A" on one and "N" on the other was due to Scheller and not the Bureau of Standards. Keibitz also worked this up. See his articles in the *Jahrb. d. Drat. Tele.,* xv, p. 299, 1920, recording his experiments since 1916.

Honor, sir, to whom honor is due, in science anyway.

There seems to be a lack of quantitative data on buried antennae in available public press. If Dr. Rogers has released some data, and has managed to eliminate fading, he has done something worthy. Long, buried aerials should help to solve the trans-Atlantic relaying problems, as such aerials should not take up much room and consequently the capital expenditure by large cities for transmitting stations and receivers would be considerably diminished.

Thank you for the excellent articles on ultra-short wave work. They were greatly appreciated.

A. F. BAYES, 5XZ,
45 Lavender Gardens,
London, England, S.W.

AN ARC IS AN ARC

Editor, RADIO NEWS:

Re the arc work commented upon by G. L. "WXE," Brooklyn, pertaining to performance of KDHW and WBN, would like to inform him of the following:

The writer is fully aware of the excellent work done week after week by WBN and other arcs on the coast to coast run; however, I believe the work accomplished by KDXE, the S.S. *Jacob Luckenback,* excelled that of any,—power and conditions considered.

Marsh, Thornton and another man, as well as the writer, helped in the installation of a 2-K.W. arc on KDXE, as the "test" set of a possibly large contract with the Luckenbach company some time ago.

Mr. N. R. Kuhn, then branch manager of the Ship Owners' Radio Service, assigned the writer as operator aboard KDXE and informed him that if he did not make good on this "test" installation, to seek out the darkest corner of the hemisphere and there hide his head permanently.

During the trip from San Francisco to Mobile, and New Orleans, constant communication was maintained between KDXE and KFS (on 2 K.W.) and chopper transmission

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Every Brandes Product is sold subject to the approval of the purchaser. If for any reason you are not fully satisfied, if you think it does not fully come up to our guarantee that it is better than any other at the price, return it to your dealer within ten days, and he will immediately refund the full purchase price.

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This guarantee really amounts to a free trial.

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More than a million and a half Brandes Headsets and *Table-Talkers* are today doing valiant service! With each sale this time-tried guarantee assumes new strength and meaning. It is an old pledge that bespeaks the unlimited confidence of the manufacturer in his products—a confidence based on the continued acceptance of Brandes products by an alert public.

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The name to know in Radio

Superior *Matched Tone* Headset $6
$7 *in Canada*

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50¢ extra west of the Rockies
In Canada $14

Navy Type *Matched Tone* Headset $8
$11 *in Canada*

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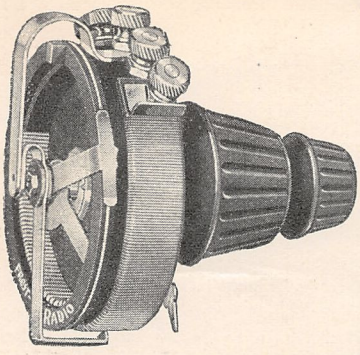

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TUBE CONTROL UNIT
No. 610 - $1.75

For beauty of design, perfection of finish, fine workmanship and sound construction according to approved radio manufacturing standards, you will have to go a long way to find apparatus that excels this genuine moulded BAKELITE **FROST-RADIO** *Tube Control Unit—a piece of apparatus that will improve the operation of your set as well as its appearance.*

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No. 607—Tube Control Unit, 6 ohm vernier rheostat, 400 ohm Potentiometer **$1.75**
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YOU will have an entirely new idea of the satisfaction of receiving set assembly and operation when you install **FROST-RADIO** genuine BAKELITE parts such as the Tube Control Unit illustrated. The single-hole mounting means but one hole in the panel. Their moulded Bakelite frames and knobs are the finest ever put into such apparatus. And precision manufacture gives smooth-working operation with minimum effort and disturbance of delicate tuning adjustments. The prices of **FROST-RADIO** Apparatus are even less than those asked for inferior products. All these items have triple nickel plated, hand buffed metal parts, finest quality resistance wire and superb polished finish Bakelite base and knobs.

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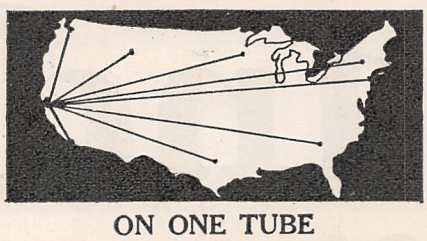

ON ONE TUBE
Broadcasting from Atlantic Coast, Mexico, Hawaii, Canada and Cuba heard in California by users of CROSS COUNTRY CIRCUIT. Range due to simplicity of set and only one tuning control. Easily and cheaply built by any novice. Dry cell tubes may be used. All instructions, blueprint panel layout, assembly photo, etc. Postpaid, 25c. Stamps accepted.
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Mints and Chewing Gum. Be my agent. Everybody will buy from you. Write today. Free Samples.
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RED-HEAD PHONES Used and praised the world over
3000 Ohm $6.50 / 2000 Ohm $5.00 Complete with Cord and Headband. At your dealer's, or sent direct.
THE NEWMAN-STERN CO., Cleveland, Ohio

of approximately 1,700 miles was accomplished with ease.

Results were obtained despite the vagaries of the ship's generators which were in a deplorable condition,—wavering up and down the voltage scale from practically nothing to 105 volts.

It was necessary for the operators to not only work the transmitter, but examine, adjust and test the ship's generators.

At the same time, NBD was worked steadily from the east side of "the canal" up to the voyage terminus at Gulf ports.

KFS was also worked in the Mississippi River.

For a 2-K.W. arc, this is good work. What a "five" could do under like circumstances is a problem.

In these cases, the credit for long distance work can be traced directly to the excellence of the apparatus.

There is only one correct manner in which to operate an arc—that is the right one.

JACK BRONT,
2179 E. 35th Street,
Cleveland, Ohio.

KANSAS CITY, MO., AMATEURS PLEASE READ

Editor, RADIO NEWS:

I am 21 years old and have spent the last six years flat on my back. I have very few personal friends and I spend most of my time listening in on the radio. That way I have passed many hours that otherwise would have been long and tiresome.

I want to put in a low power transmitter. but I don't know much about them. The purpose of this letter is to try and find some obliging Ham who will give me some inside "dope" on transmitters.

Nearly every afternoon I hear a fellow who signs with 9ADR. I enjoy listening to him talk to his amateur friends, but I would like it better if I could cut in and say a few words for myself once in a while. Therefore, this letter asking for some information.

MAX J. COLVIN,
208 N. Jackson.
Kansas City, Mo.

I Want to Know

(*Continued from page* 345)

Small boats, if equipped with direction finders, may easily locate their mother ship. Transmitting stations unlawfully operating may be located.

Q. 3. What is meant by "beam transmission"?

A. 3. This is the new term given to radio transmission where the maximum amount of energy is focused in one direction.

COMPASS STATION LOOP AERIAL

(2017) Mr. John T. Banks, Wilmore, Ky., wants to know:

Q. 1. Please give design data for a direction finding loop of a size that will tune to the radio beacon wave-length of 1,000 meters; this loop to be similar to the ones used on ship board.

A. 1. Cross two light pieces of wood seven feet long, at an angle of 90 degrees. Fasten seven-inch wooden or bakelite spreaders on the four ends. This frame is wound with 12 turns of No. 20 insulated copper wire spaced one-half inch. This will form a square of approximately five feet on each side. A condenser having a maximum capacity of at least .0007 mfd. will be required in shunt with this loop.

Q. 2. Where can this loop be tapped for reception of broadcast stations?

A. 2. A tap is taken at the sixth or seventh turn.

Q. 3. Is a loop aerial always directional?

A. 3. No.

WAVE FRONT DISTORTION

(2018) Mr. Clyde M. Louny, Buhl, Idaho, asks:

Q. 1. Does the metal of a ship have any effect on radio waves, when using a loop aerial?

A. 1. The ship's mass may often introduce a distortion error of as much as 20 per cent.

Q. 2. When would a distortion effect be most noticeable?

A. 2. When the sending station is on a line 45 degrees from the ship's center line.

Still Better

New Crosley Radio Receivers

THAT Crosley Radio Receivers have given complete satisfaction in the past is evidenced by the fact that, during the last twelve months, The Crosley Radio Corporation produced more receiving sets than any manufacturer in the world. That the new line of Crosley instruments, illustrated herewith, will give even better service is assured by the exhaustive tests to which each model has been subjected both in our laboratories and in actual use under all weather conditions.

Each Crosley Model is designed to give the utmost efficiency at the lowest cost.

Before you purchase a radio receiver listen in on a Crosley. Compare its performance with any other instrument on the market. We know then that you will choose a Crosley.

See the Crosley line at your dealers.

Crosley 50, $14.50

Crosley 51, $18.50

Crosley 51-P, $25.00

Crosley 52, $30.00

Crosley Tirdyn 3R3, $65.00
And Below Crosley
Trirdyn Special, $75.00

CROSLEY 50—A new one tube Armstrong Regenerative Receiver. We believe this to be the most efficient one tube receiver ever put on the market.....**Price $14.50**
Crosley 50-A, two tube amplifier may be added at $18.00

CROSLEY 51—Two tube regenerative receiver, the biggest selling radio receiver in the world. Gives loud speaker volume on local stations at all times and on distant stations under average conditions.....**Price $18.50**
Crosley 51-A, one tube amplifier may be added at $14.00

CROSLEY 52—A new three tube Armstrong Regenerative Receiver. Provides loud speaker volume on distant stations under practically all conditions.....**Price $30.00**

CROSLEY 51-P—This is our new portable set. It is the Crosley Model 51 two tube receiver mounted in a leatherette covered carrying case, battery space and space for head phones all self-contained.....**Price $25.00**

CROSLEY TRIRDYN 3R3—This three tube receiver gives the efficiency and volume of five tubes. We believe it is the most efficient receiver on the market at any price for bringing in long distance stations.....**Price $65.00**

CROSLEY TRIRDYN 3R3 SPECIAL—The same as the Trirdyn 3R3 except cabinet is larger to contain "A" and "B" dry cell batteries and accessories. A beautiful set to match the highest grade of furniture.....**Price $75.00**

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All Crosley Regenerative Receivers licensed under Armstrong U. S. Patent, 1,113,149

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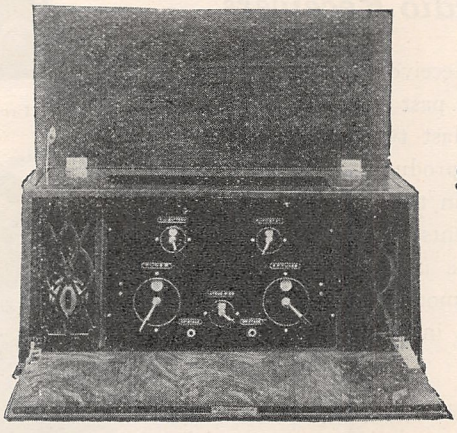
MICHIGAN

The Best Four Tube Set On the Market Today

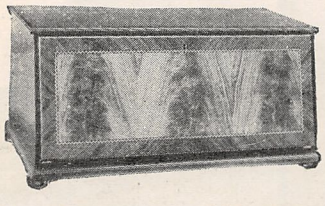


$150.00

All the genius of the Radio Engineer has been combined with the art of the cabinet builder to make this Michigan 4 tube set "supreme."

Built-in Loud Speaker, with adjustable unit, so that all ranges of tone are received in faithful reproduction. Four tubes for distance and volume—working equally as well with dry cell or 6 volt standard tubes.

Inlaid cabinet, with drop hinged front, of beautifully grained mahogany, is the finest the cabinet manufacturers have ever produced. Go to your dealer; let him show you this wonder set. We will be glad to send you illustrated descriptive folder of our complete line if you will write us.



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GENUINE LAVITE RESISTANCES

The ONLY perfect, distortionless resistances for resistance coupled amplification.

12,000 OHMS
48,000
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PRICE $1.50 EACH

SPECIAL SIZES TO ORDER

Mail Orders Filled. Dealers Communicate.

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$25 FOR $10

THE FAMOUS BEL-CANTO Loud Speaker PRICE $10

Direct from Factory to you. Delivered free C.O.D. to your door.

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Get a Handy Binder for your RADIO NEWS. Holds and preserves six issues, each of which can be inserted or removed at will. Price 65c. Experimenter Pub. Co., Inc., Book Dept., 53 Park Place, N. Y.

Q. 3. When is distortion least noticeable?

A. 3. Wave distortion is zero with the wave front traveling lengthwise of the ship.

COMPASS LOOP ACCURACY

(2019) Mr. Henry Smith, N. Plainfield, N. J., requests:

Q. 1. What is the most accurate way for taking compass loop bearings?

A. 1. With weak signals, a bearing is taken in the line indicated by the loop when set for maximum signal strength. When taking the bearing of a station of greater power, greatest accuracy is had when the adjustment is made for minimum signal strength.

Q. 2. Please describe a loop having a direction finding accuracy of two or three degrees.

A. 2. The loop described in answer to question No. 2017, above, has this efficiency, when using the minimum signal strength method just described.

Q. 3. What is the approximate range of a standard loop receiver using one tube without regeneration?

A. 3. The rated range is 50 miles.

WAVE-LENGTH FREQUENCIES

(2020) Mr. C. P. McCornell, Los Angeles, Calif, writes:

Q. 1. Should the ship's antenna be grounded when taking compass bearings?

A. 1. It is very important that the aerial be grounded, for accurate results.

Q. 2. What does D/F mean?

A. 2. This is the symbol for direction finding (radio compass) stations, or bearings.

Q. 3. Please give the frequencies of the following wave-lengths: 100, 200, 360, 400 and 600 meters.

A. 3. These frequencies are 3,000 kilocycles (abbreviated KC.); 1,500 KC. 833.3 KC.; 750 KC., and 500 KC. respectively.

Upholding Your Profession

(*Continued from page* 342)

tain how to run his ship. The writer once tried it and lost the best ship he ever had! It was a well deserved lesson.

If on a passenger ship, the problems are greater. Ordinarily, the operator is permitted but little social intercourse with the passengers. Should he be assigned to a vessel where a few social privileges are extended, the best policy is not to abuse them. As a representative of the steamship and radio companies, the operator's demeanor to the passengers must be courteous and respectful at all times.

One more point, do not become friendly with deck hands, oilers, etc. There are splendid fellows among them, of course, and ashore and off duty there is no objection to such association, but aboard ship such relations must be suppressed as a precautionary measure against the wrong sort of public opinion. This is particularly true on a passenger vessel.

The operator should accept no menial tasks and should at all times conduct himself as a gentleman. The dignity of the profession can be recalled and upheld only by the conduct of the men in it.

A LONG WAVE RECEIVER FOR THE SEA-GOING OPERATOR

By W. C. ELLSWORTH

On the more distant runs, in order to copy PX, the sea-going operator is required to use some form of long wave receiver other than the ship's regular equipment. It is quite essential that this receiver should have a wave-length range from 6,000 up to 24,000 meters.

A great number of operators on vessels equipped with the type SE-143 receiver and the SE-1071 audion control, reach these higher waves by loading the primary, secondary and tickler circuits. This method requires the use of three inductance coils, coil holder, and in some cases, auxiliary variable condensers. Shifting from the use of the regular set to this arrangement generally requires several changes of connections and a number of adjustments.

"THE AIR
IS FULL OF THINGS
YOU
SHOULDN'T MISS"

Sustained power!

WHERE table or cabinet space is limited, use this *new* vertical 45-volt Eveready "B" Battery No. 772. It has the same long life, the same steady high power as the horizontal Eveready 45-volt "B" Battery, but because it stands upright it takes less than half the table space.

Tables and most battery cabinets have more headroom than floor space. This battery is built in recognition of that fact. It fits the Radiola Super-Heterodyne cabinet perfectly.

Many multi-tube receiving sets use a "hard" detector tube which does not require fine adjustment of "B" voltage, so the new Eveready Vertical 45-volt "B" has but three plainly marked terminals, negative, plus 22½ and plus 45 volts.

Standing upright to save space, made of large, powerful cells to last longer, here is the battery you've been looking for.

Manufactured and guaranteed by

NATIONAL CARBON COMPANY, INC., New York—San Francisco

Headquarters for Radio Battery Information

Canadian National Carbon Co., Limited, Toronto, Ontario

If you have any battery problem, write G. C. Furness, Manager, Radio Division, National Carbon Co., Inc., 122 Thompson Ave., Long Island City, N. Y.

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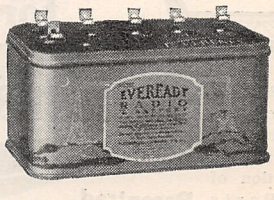
Radio Batteries
–they last longer

Eveready "B" Battery No. 772 for detector and amplifier. Connections at 22½ and 45 volts. Three Fahnestock Clips. Approximate over-all dimensions, 8¼ in. x 3¼ in. x 7¾ in.

Eveready 6-volt Storage "A" Battery

No. 767
"B" Battery, 45 volts
Variable taps
Fahnestock Clips

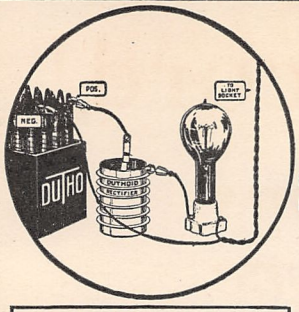


No. 766
Eveready "B"
22½ volts
Six Fahnestock
Spring Clip
Connectors

No. 771
Eveready "C" Battery. Clarifies tone and prolongs "B" Battery life

No. 764
The Space Saver
Vertical
22½-volt
"B" Battery

No. 7111
Eveready Radio "A"
Dry Cell
Specially manufactured for use with dry cell tubes

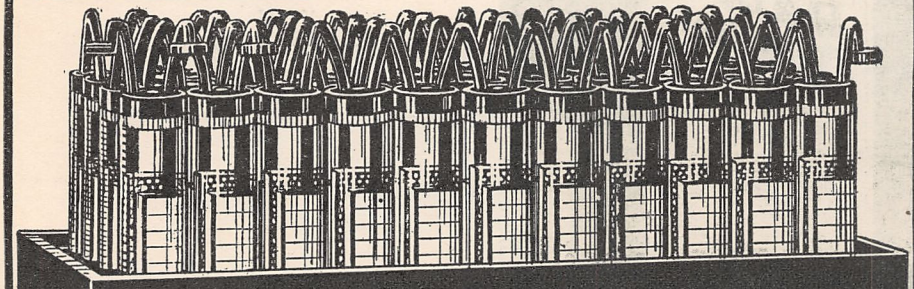


after you have experimented with Dry Cells—hook on

SUPER-DUTHO
Rechargeable Storage
"B" BATTERIES

Duthoid Chemical Rectifier $1.80 charges up to 90 volts at one time

and note the difference. Possibly what you think is static comes from your dry cells.



3500 M. A.

24-Volt . . . $9

45-Volt . . . $17

90-Volt . . . $32

Super-Dutho "B" Batteries are shipped dry. Solution is in separate container.
(707)

Write for booklet on Storage "B" Batteries
DURKEE-THOMAS Products Co.
1228 Folsom Street, San Francisco
Dealers—Write for special proposition

Super-Dutho "B" Batteries are shipped anywhere—prepaid—check must be included

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FREE Super-Heterodyne Blue Print showing complete hook-up of the famous Grieff 8-Tube Super.

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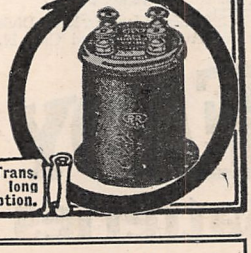
Replace all others with "RECEPTRAD"

Receptrad Parts
for the Super-Heterodyne—a complete package
1 Oscillo-Coupler, Type SW-21
1 Tuned Filter Coupler, Type H-34
3 RF-1716 Transformers—Range 5 to 25 M. meters
1 Audio Transformer, Type AT3
1 Audio Transformer, Type ATX
2 1MF By-Pass Condensers, Type G-1000
PRICE $53.50
Lieut. Greiff's Super-Heterodyne Manual, $1.50
Write for complete literature and prices on individual items



RADIO RECEPTOR CO.
59 Bank Street New York City

R.F.1716 Trans. for all long wave reception.

Get a Handy Binder for your RADIO NEWS. Holds and preserves six issues, each of which can be inserted or removed at will. Price 65c. Experimenter Pub. Co., Inc., Book Dept., 53 Park Place, N. Y.

The circuit commonly known as the "Gibbons hook-up" is quite efficient for long wave reception and more than a few operators claim it is *the* circuit for long wave work. Fig. 1 shows this circuit, while Fig.

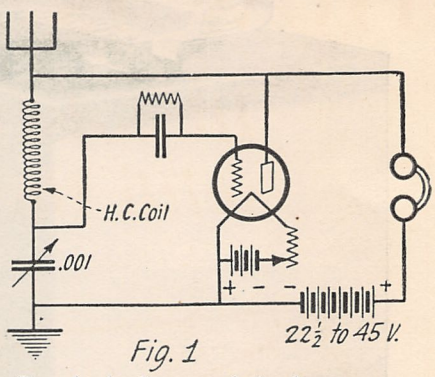


Fig. 1

The circuit diagram of the long wave receiver employing a single honeycomb coil.

2 shows the connections by which it can be effected using the SE-1071 audion control, honeycomb coil, and one .001 mfd. variable condenser.

To change from the regular set to long waves, disconnect Tickler, RA, and RE connectors. Connect the antenna lead to both the tickler binding posts and to one terminal of the honeycomb coil. The other terminal of the coil is connected to the fixed plates binding post of the variable condenser and to the RA binding post. Connect the ground lead to the movable plates binding post of the variable condenser and to the RE binding post.

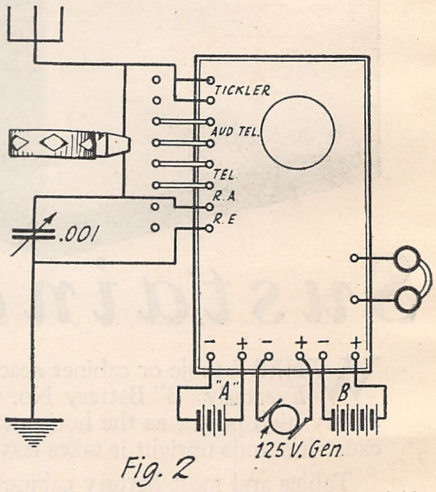


Fig. 2

Manner in which the honeycomb coil, variable condenser and batteries are connected up to a standard "SE" audion control panel.

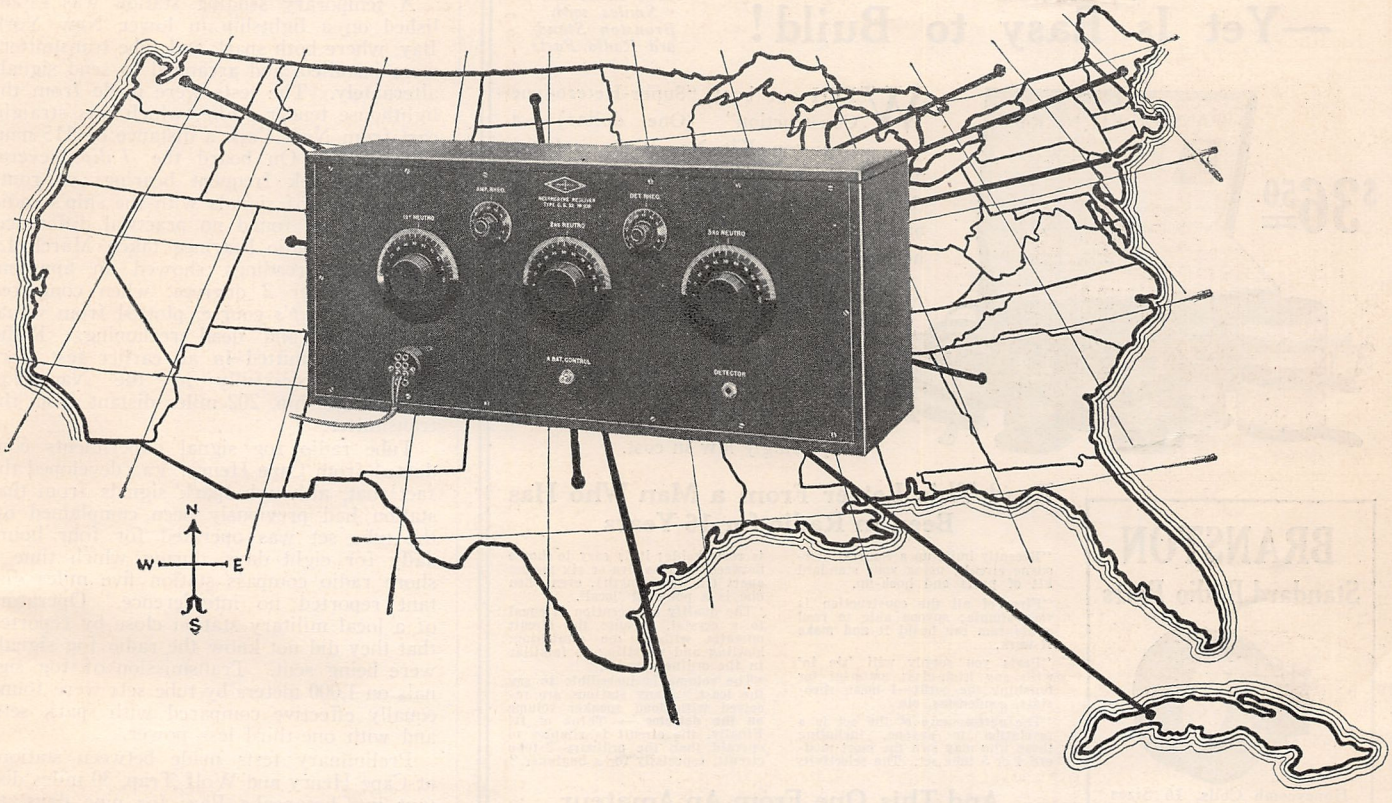
Varying both grid condenser and bridging condenser switches on the audion control aids tuning. Bridging condenser switch must be used on "Max" for the very long waves. With a honeycomb coil of 1,000 turns, stations such as NBA, NPL, GBL, GKB, POZ and OUI can be tuned in, but to hear the longer waves of NSS, LY, ICC, MUU, GBL and POZ, a 1,500 turn coil must be used. This scheme of connection gives very good results, tunes quite sharply, and, for consistent, practical, all-around reception, works fully as well as the three-circuit hook-up.

RADIO FOG SIGNAL STATIONS TO TRANSMIT WITH TUBES

Eventually a system of 47 radio fog signal stations, each with a tube transmitter, will be operated by the U. S. Lighthouse Service. There are now 10 spark stations, and one new tube set, which was installed recently on the Ambrose Channel Lightship, off New York.

How is this for a record!

Illinois fan gets 210 stations with the Murdock Neutrodyne



THIS Dwight, Illinois, fan says: "I got my Murdock Neutrodyne in the latter part of January and have had 210 stations, 24 of them over 1000 miles distant. I have had Porto Rico, two stations in Cuba, Mexico City, Portland Oregon, and six stations in Canada: Regina, Calgary, Winnipeg, Montreal, Toronto and Ottawa . . . .

"I have been able to get Havana when a super-heterodyne could not pick it up. I have also picked up about 50 amateurs, and got stations in low wave-lengths that no one else here seems to get. . . "

Licensed by Independent Radio Manufacturers Inc. NEUTRODYNE Reg U S Pat Off. Pat March 27 1923 and April 1, 1924. Hazeltine Pats Nos 1,450,080 and 1,489,228 Other Patents Pending.

A superb radio investment

WITH the Murdock Neutrodyne you have at your command a great range. You receive local and distant stations with wonderful clearness and volume — and without interference. Easy to operate, selective, handsome in appearance—the Murdock is one of the best receiver values on the market.

Let your dealer demonstrate the Murdock Neutrodyne for you. Absolute satisfaction is guaranteed.

RADIO MURDOCK

WM. J. MURDOCK CO., 366 Washington Ave., Chelsea, Mass.

Branches: New York, Chicago, San Francisco

MURDOCK RADIO PRODUCTS

Standard since 1904

Send for this free booklet

WM. J. MURDOCK CO.,
366 Washington Ave., Chelsea, Mass.

Gentlemen:
Please send me, without obligation, your Free Booklet describing the Murdock Neutrodyne Receiver.

Name .....

Street .....

City ..... *State* .....

BRANSTON RADIO

(Reg. U. S. Pat. Office)

The Super-Heterodyne Gives the Most Perfect Reception —Yet Is Easy to Build!

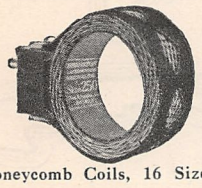
Add Miles and Smiles with Branston Standard Radio Parts

$36.50

WITH our book "Super-Heterodyne Construction" (One dollar) — a Branston Kit No. R-99, and the necessary standard radio parts listed in the book, any radio amateur can easily build one of these remarkable sets—and he will have the most perfect type of receiving instrument possible at this time, regardless of amount of money invested.

The two most surprising things about the Super-Heterodyne Receiver are that it is easy to build and surprisingly low in cost.

BRANSTON
Standard Radio Parts



Honeycomb Coils, 16 Sizes

Coil Mountings all Styles

Licensed under DeForest Patents.

Audio Frequency Transformers
Intermediate Radio Frequency Transformers
Air Core Transformers
Radio Frequency Transformers
Lightning Arresters
Multiphone Jack Boxes
Series Parallel Switches
Jacks
Telephone Plugs
Head Sets, etc., etc.

Read This Letter From a Man Who Has Been in Radio for 16 Years

"Recently built up a Super-Heterodyne circuit, using your standard kit of parts and hook-up.

"First of all the construction is very simple; anyone able to read a diagram can build it **and make it work.**

"Parts you supply will 'tie in' with any high-class material for finishing the outfit—I mean rheostats, condensers, etc.

"The performance of the set is a revelation to anyone, including those who may own the most modern 4 or 5 tube set. The selectivity is remarkable; it is easy to choose between stations five or six meters apart (in wave-length), even when one is a powerful 'local'.

"The quality of reception is equal to a crystal, because the circuit operates without the scratching, howling and whistling so familiar in the ordinary radio.

"The volume is incredible to say the least. Many stations are received with loud speaker volume **on the detector** — Think of it! Finally, the circuit is simpler to operate than the ordinary 3-tube circuit, especially for a beginner."

And This One From An Amateur in Reading, Pa.

"Expecting you are always glad to hear of the success or failure of your parts, we are taking the liberty of writing you on your Super Het. Parts.

"We put the set in operation and we are using 4 stages Radio and two Audio Frequency, and have logged most every worthwhile station in U. S., also 2-LO England who were very plain on a Loud Speaker with 1 stage Audio. Most all midwest stations come in plenty loud on Loud Speaker just using detector."

Your dealer has Branston Kits or can get them for you

CHAS. A. BRANSTON, Inc.
817 MAIN STREET BUFFALO, N. Y.
In Canada—Chas. A. Branston, Ltd., Toronto
In England—Chas. A. Branston, Ltd., London

Die-Madera Cast Wood "CLEARSPEAKERS"

Are all WOOD all-the-way-down

The wonderful performance of "Madera" die-cast wood is sending metal radio horns into the discard.
Madera Clearspeakers are not camouflaged wood with metal throat and wood bell—but are **all** die-cast wood, much denser than natural wood.

Our new models are finished in rich mahogany and walnut effect, as well as in black or brown crystal finish. No. 804, here illustrated, 12 inches high, in crystal, only $15.00.

Send for circulars.

AMERICAN ART MACHE COMPANY
343 West Austin Avenue Chicago, Illinois

EARN MONEY AT HOME

YOU can earn $1 to $2 an hour in your spare time writing show cards. No canvassing or soliciting. We instruct you by our new simple Directograph System, supply you with work and pay you cash each week. Write today for full particulars and free booklet.

WEST-ANGUS SHOW CARD SERVICE LIMITED
Authorized Capital $1,250,000.00
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HUDSON-ROSS

Wholesale radio only.
One of the first and still in the lead.
Write for discounts.
123 W. Madison St. Chicago

Write for complete illustrated FREE Catalog of

PARAGON

Reg. U. S. Pat. Off.

RADIO PRODUCTS

ADAMS-MORGAN CO.
6 Alvin Place Upper Montclair, N. J.

Speaking before the National Academy of Sciences, Commissioner of Lighthouses G. R. Putnam reviewed the development of the radio fog signals for the protection of navigation, first established by the Lighthouse Service three years ago with three spark stations near New York. Recent tests using 250-watt transmitting tubes, with a view to providing a signal which could be tuned more sharply to the proper wave, thus lessening interference, and a more powerful and economic signal, have proven successful. It was also developed that there was practically no difference in the direction of radio bearings taken from tube or spark transmitted signals, but that far greater interference was caused by the latter.

A temporary sending station was established on a lightship in lower New York Bay, where both spark and tube transmitters were installed, and arranged to send signals alternately. The tests were made from the lighthouse tender *Tulip*, which was straight east from New York a distance of 115 nautical miles. On board the *Tulip*, several observers took frequent bearings en route on both sets of signals with the ship's radio compass, and found no practical difference. Out of 93 radio bearings taken March 13, only seven readings showed an apparent error of over 2 degrees, when compared with the *Tulip's* course, plotted from visual observations and dead reckoning. Radio signals transmitted in an earlier test were received successfully by the Nantucket Shoal Lightship, 202 miles distant from the transimtter.

Tube radio fog signal experiments conducted from Cape Henry, Va., developed the fact that, although spark signals from that station had previously been complained of, the tube set was operated for four hours daily for eight days, during which time a shore radio compass station five miles distant reported no interference. Operators of a local military station close by reported that they did not know the radio fog signals were being sent. Transmission of fog signals on 1,000 meters by tube sets were found equally effective compared with spark sets, and with one-third less power.

Preliminary tests made between stations at Cape Henry and Wolf Trap, 30 miles distant in Chesapeake Bay, for nine days, to study the so-called night effects on radio bearings at sunrise and sunset, showed that such disturbances do not seriously affect radio bearings. They did demonstrate, however, that it was difficult to be accurate during these hours, and shall serve as a warning for greater care in taking bearings around sunrise and sunset.

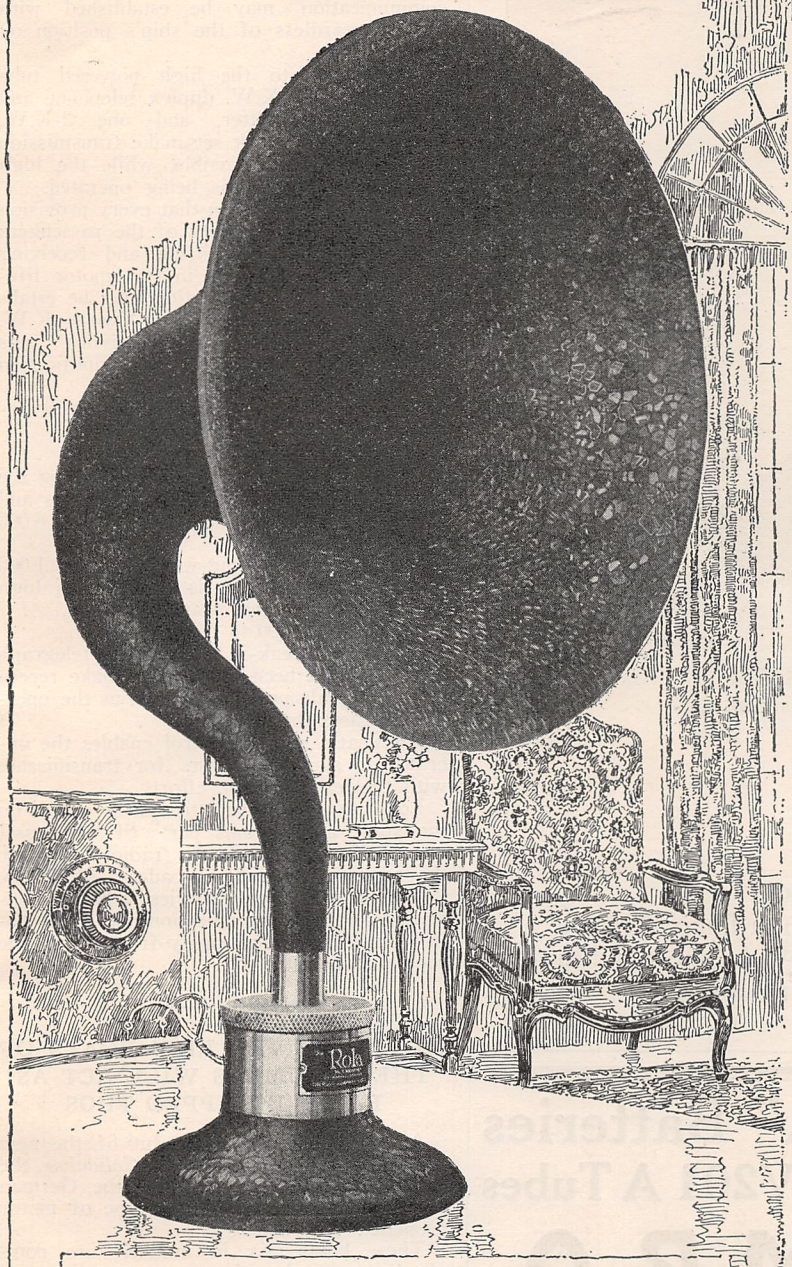
Out of 260 bearings taken on a single-coil compass at Wolf Trap, only two showed a deviation from the mean of 3 degrees, and only three reached 2 degrees; these were during static and when the receiving set was not operating properly, it was said.

THE RADIO INSTALLATION ABOARD THE LEVIATHAN

Aboard the steamship *Leviathan*, largest ship of the United States Lines, and largest vessel afloat, when she recently sailed from New York to European ports, was the most modern and best equipped radio station in the world. New equipment installed aboard the great liner gives her a radio outfit that represents the last word in efficiency. A staff of eight operators, headed by Chief Radio Officer E. N. Pickerill, none of whom have had less than 10 years' experience, and two messengers, are included in the personnel necessary for the handling of the radio service. It is the largest radio personnel on any ocean liner.

From the time the *Leviathan* leaves her pier until her return, duplex watches are maintained at all times in the radio room to insure the reception and transmission of

They said it couldn't be done!



The ROLA RE*CREATOR horn is exponential in taper and non-resonant at any audible frequency. The reproducer mechanism responds over a frequency range from 150-9000 which is greater than that achieved by present broadcasting stations. The sensitivity exceeds that obtained in best headset construction—an unparalleled achievement in loud-speaker design. The unit can be purchased separate from the horn and base, together with the necessary adapter for attachment to any phonograph.

The requirements of a perfect reproducer are but three:

1. *Tone-quality*
2. *Volume*
3. *Sensitivity*

But for years engineers have failed to obtain these three qualities in a single instrument.

Tone-quality? Exquisite tone-quality was obtained, but without adequate volume.

Volume? "Loud"-speakers were blatant—without tone-quality and usually insensitive.

Sensitivity? Sensitive reproducers chattered hopelessly on loud-reproduction.

Acoustic engineers finally said it couldn't be done.

—but Rola did it!

For here at last is a reproducer that has *all* of these essential qualities. And it marks a new era in Radio reproduction.

Here is a loud-speaker of such tonal perfection that comparisons are astounding. Of such sensitivity that any signal that can be amplified will be reproduced—adding many miles to radio reception. And yet capable of tremendous volume on power inputs — for it cannot chatter!

There's absolute proof in a demonstration.

Hear it at your dealer's.

Price complete with 14-inch horn and cord, $36.00

A Product of

THE ROLA COMPANY

SEATTLE, WASHINGTON · U S A

Distributed nationally to the jobbing trade by

BAKER-SMITH COMPANY

Call Building · San Francisco

with offices in the principal cities

Rola

BAKER-SMITH COMPANY
L. C. Smith Building
Seattle, Washington

Gentlemen: Please send complete information regarding the new Rola Re*Creator.

Name _____

Street _____

City _____

My dealers name _____

"What a whale of a difference just a few cents make!"

—*all the difference*
between just an ordinary cigarette
and—FATIMA, the most skillful
blend in cigarette history.

traffic without delay. This was made possible by the installation of additional receiving equipment for tuning in stations on long and short waves simultaneously, combined with the ability to transmit and receive messages on different wave-lengths at the same time. Five antennae are used, three for transmission and two for reception.

The transmitting installation includes one high powered tube transmitter, which is used on wave-lengths of 1,800, 1,935, 2,100, and 2,400 meters. With this transmitter, communication may be established with shore, regardless of the ship's position on the Atlantic.

In addition to the high powered tube transmitter, a 1-K.W. duplex telephone and telegraph transmitter, and one 2-K.W. Navy standard spark set make transmission on shorter waves possible, while the high powered transmitter is being operated.

It can readily be seen that every provision was made for the safety of the passengers when complete transmitting and receiving apparatus was installed in two motor lifeboats, so that communication may be established after they are launched. Two ½-K.W. transmitters and two receiving sets equipped with two steps of amplification have made this possible.

The receiving equipment in the radio station consists of the following:

One duplex telephone receiver.

One special rejector receiver, enabling the operation of two telegraph transmitters and receivers simultaneously on 600 to 8,000 meter wave-lengths.

One Navy type long-wave receiver 1,000 to 25,000 meters for listening in on high powered Government stations.

One receiver 300 to 7,000 meters.

Automatic break-in systems for telegraph receivers have been installed to make reception of signals possible as soon as the operator releases the key.

Automatic remote control enables the operator to start generators for transmission with the least possible effort.

Loud speaking apparatus can be placed on the stage and various parts of the vessel connected direct with the radio room for the reception of radio broadcast programs.

Auxiliary storage batteries have been installed so that communication may be established in case power supply from the engine room has been cut off.

MOTOR DRIVEN LIFE BOATS OF THE COLUMBUS WILL ACT AS RADIO-EQUIPPED TUGS

A feature of the equipment of the new North German Lloyd steamer *Columbus*, the largest and fastest vessel in the German Merchant Marine, is a new type of motor propelled life boat.

These boats, six in number, are completely equipped with antenna, sending and receiving instruments. Current is supplied by a miniature generator operated by the boat's motor.

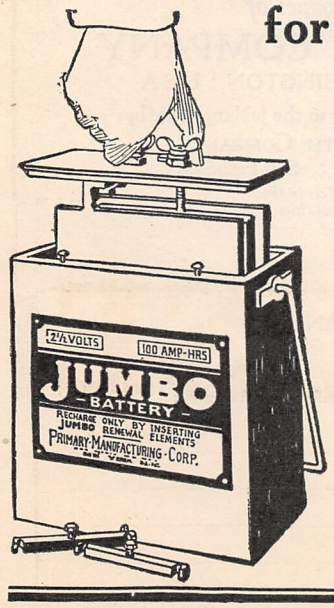
Upon the instant of launching, these radio stations are ready for service. The range is from 330 to 660 yards.

A great stride in life boat efficiency is here represented. A serious handicap, heretofore encountered by life boats becoming separated after leaving the ship, has been overcome.

The motor life boats of the *Columbus*, besides accommodating 40 persons, are equipped with motors powerful enough to tow a long line of other life craft. Thus, navigating at all times in constant radio communication with other tows leaving the vessel, until land or a ship is reached.

The six motor boats are fully equipped with water, provisions, lights, signals, compasses and other navigating necessities for safety and comfort.

100 Ampere Hour "A" Batteries
for WD12 and UV201 A Tubes



JUMBO
Instantly Recharged
without electrical equipment at home, or at Jumbo Service Dealers **WHILE YOU WAIT**

NEVER NEED REPAIRS
Every Recharging Completely Renews the Battery

30 Days Trial
Ask Your Dealer—or Write Directly to Us for our 30 Day Trial Plan

We Offer an Attractive Proposition to Dealers —and a Few Exclusive Territories to Distributors

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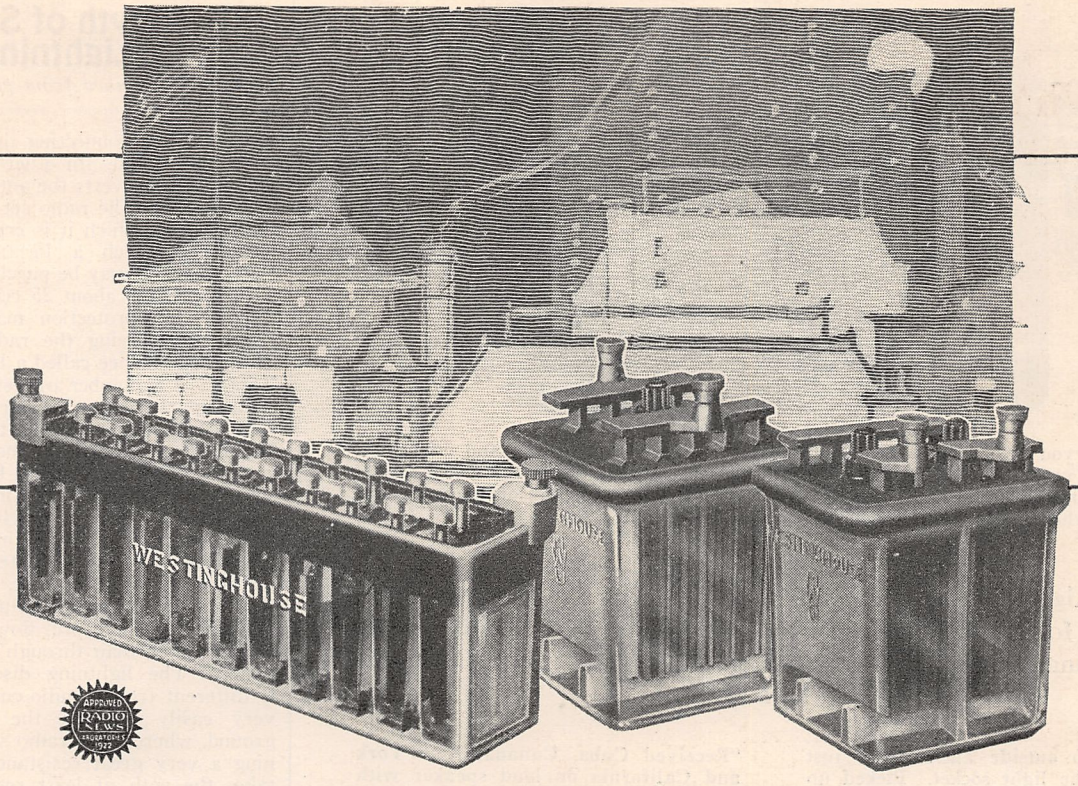


NOTHING about a radio set is so absolutely essential to satisfactory receiving as *good batteries.* Sustained voltage, slow, even discharge, ample capacity, utmost quiet, long life—these are important. Don't be satisfied with anything less than Westinghouse Radio Storage Batteries. They are built to meet the most exacting requirements of radio broadcast transmission and reception. And they last! Thoroughly insulated against current leakage. Easily recharged. A size and type for every radio need.

Westinghouse Crystal Case Radio Batteries have one-piece clear glass cases, with glass cell partitions and high glass plate rests (deep sediment spaces). "A" Batteries in 2, 4 and 6 volt sizes. 6-volt size made in rubber-case types too. "B" Batteries in 22-volt units—regular and quadruple capacities. "C" Batteries in 6-volt units.

WESTINGHOUSE UNION BATTERY CO.
Swissvale, Penna.

WESTINGHOUSE

Radio "A," "B" and "C"

BATTERIES

Bedtime Stories *Morning Exercises*

WHEN you own a Radiodyne the world's foremost entertainers and educators serve you. With this efficient receiving set you can bring operas, sermons, lectures, dance music, etc., right into your home clear and distinct on loud speaker no matter where broadcasted or where you live.

Uses Light Socket for Antenna

RADIODYNE

Uses Outside or Inside Aerial For Daytime

"I have no outside antenna. I just plug into the light socket. Picked up Omaha last Sunday morning at ten o'clock when the temperature was 95 and the sun shining."

FRANK WILLIAMS, Winona, Minn.

"Received Cuba, Canada, New York and California on loud speaker with 70 foot ribbon antenna in attic. Also have a single 75 foot wire outside for daytime, volume and distance."

L. G. GEORGE, Fairmount, Ill.

Write for illustrated folder which describes the RADIODYNE in detail. Every radio fan will be interested in this new type receiver.

WESTERN COIL & ELECTRICAL CO., 314 Fifth Street, RACINE, WIS.

DEAL WITH THE MANUFACTURER

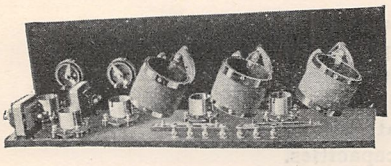
DIRECT AND SAVE MONEY

Insure yourself for BETTER SERVICE and GREATER SATISFACTION, HIGH QUALITY and LOW PRICE.

Neutrodyne A & P 5 Tube Set Knock-Down

Every part that is needed to BUILD an A & P NEUTRODYNE is included in the kit at this REMARKABLY LOW PRICE.

Price $25.95



Price $25.95

These parts are constructed in our factory according to NEUTRODYNE specifications, and are guaranteed to be the BEST MONEY CAN BUY. No shellac or varnish which introduce losses. Silk covered wire wound on genuine Bakelite.

GREATER ATLANTIC & PACIFIC RADIO CORP.

223 West 34th Street, New York City

Enclose Postage with Order

199 NECESSITIES

WIMCO 199 SOCKET ..... $ .75
WIMCO 199 C SOCKET 1.00
WIMCO 199 ADAPTER ..... .75

Send for free literature
Jobbers' inquiries solicited

THE WIRELESS MFG. CO., Canton, O.
MANUFACTURERS—DISTRIBUTORS

Don't You Get Tired of only hearing LOCAL stations on your Crystal Set? There's music on your aerial every night from stations far away. If you want to hear it without buying a tube set, WRITE ME TODAY.

LEON LAMBERT
595 South Volutsia Wichita, Kansas

The Myth of Summer Lightning

(*Continued from page* 326)

thrown down, connecting the antenna directly to the ground. In other words, the lightning switch converts the antenna into a lightning-rod when the radio set is not in use and the house on which it is erected has the full protection which a lightning-rod affords. Such a switch may be purchased in any electrical store for about 25 cents.

The same protection may be had while receiving or using the radio set by means of a simple device called a lightning arrester. There are a number of devices of this sort on the market but whatever device is used it should be one approved by the Board of Fire Underwriters. Most of these arresters consist of a small gap formed by two metal rods separated a short distance in a vacuum. The two terminals are connected as in Fig. 2. The tiny gap in the lightning arrester is connected across the antenna and ground posts of the receiving set, but this gap offers a tremendous resistance to radio currents which, therefore, flow through the receiver rather than through the lightning arrester. The lightning discharge is entirely different from a radio current and it flows very easily through the arrester to the ground, whereas the radio set offers to lightning a very great resistance. It, therefore, takes the path of least resistance and goes through the arrester while one is receiving. In other words the lightning arrester serves to by-pass or divert the lightning discharges through the arrester and away from the radio receiver, to the ground.

In general, if the lightning arrester is used alone, sufficient and ample protection is afforded by it against lightning. Both lightning arrester and lightning switch may be used, as shown in Fig. 3.

The number of lightning strokes doing damage is extremely rare considering the total number of strokes each year. Railroad accidents, subway accidents and so on occur, yet one would not think of *discontinuing* to ride on a subway or railroad train.

List of Broadcast Stations

(*Continued from page* 346)

KGB	Tacoma, Wash. Tacoma Daily Ledger.
KXD	Modesto, Calif. Modesto Herald Pub. Co.
WABO	Rochester, New York. Lake Ave. Baptist Ch.
WABT	Washington, Pa. Holliday-Hall Radio Eng.
WBBQ	Pawtucket, R. I. Frank Crook.
WIAB	Rockford, Ill. Joslyn Auto Co.
WIAI	Springfield, Missouri. Heer Stores Co.
WTAL	Toledo, Ohio. Toledo Radio & Electric Co.

254 METERS—1180 KILOCYCLES

KFGC	Baton Rouge, La. Louisiana State University.
KFJZ	Fort Worth, Texas. Texas National Guard.
KFLR	Albuquerque, N. M. University of New Mexico.
KFMB	Little Rock, Ark. Christian Churches of Little Rock.
KFNG	Coldwater, Miss. Wooten's Radio Shop.
KFOU	Richmond, Calif. Hommel Mfg. Co.
WAAN	Columbia, Mo. University of Missouri.
WABM	Saginaw, Mich. F. E. Doherty.
WIAD	Ocean City, N. J. Ocean City Yacht Club.
WJAK	Greentown, Ind. Rev. Clifford L. White.
WKAV	Laconia, N. H. Laconia Radio Club.
WLAV	Pensacola, Fla. Electric Shop, Inc.
WMAH	Lincoln, Neb. General Supply Co.
WMAW	Wahpeton, N. D. Wahpeton Elect. Co.
WSAR	Fall River, Mass. Doughty & Welch Elec. Co.
WTAQ	Osseo, Wis. S. H. Van Gordon & Son.

256 METERS—1171 KILOCYCLES

KNV	Los Angeles, Calif. Radio Supply Co.

Why Buy Batteries More Than Once!

When you buy Willard Rechargeable B Batteries you're through going down into your pocket for B batteries every little while.

For unlike the ordinary battery which lasts only a few months, Willard Rechargeable B's are good for years—with average care at least five, and probably more.

Just figure up how much you'll save if you don't have to spend a cent for B batteries in the next five years.

The real value of Willard Rechargeable B Batteries, however, is to be measured not in dollars and cents but in improved results.

That's why they are not only the leading batteries for receiving, but also for broadcasting. They're used by 134 stations.

Your Willard Service Station or Radio Dealer will be glad to demonstrate the superiority of Willard B Batteries. Ask him, too, for the free booklet, "Better Results from Radio", or write direct to the Willard Storage Battery Company, Cleveland, Ohio.

Willard B Batteries

Willard Rechargeable B Batteries are made in two types, one of 2,500 m. a. h., the other of 4,500 m. a. h. capacity. Each of these types can be purchased in 24 or 48 volt units. Glass jars enable you to see the condition of your battery at all times and help prevent electrical leakage.

Willard A Batteries

Good A Batteries are as important as good B Batteries. There are several types of Willard A Batteries in a range of prices, including the Willard All-Rubber A Battery, with rubber case and Threaded Rubber Insulation. Capacities from 90 to 120 ampere hours.

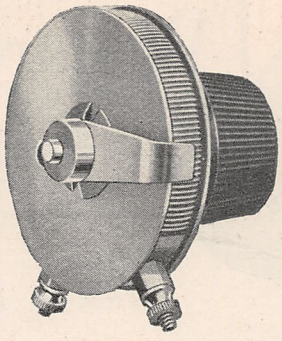
For Peanut Tubes

A leak-proof, noise-free storage battery that costs little, lasts for years and has many advantages over the ordinary peanut tube battery. See your Willard Dealer, or send for descriptive literature.

Willard Rechargeable Batteries for Radio

Have you heard WTAM, Willard's own Broadcasting Station? Wave length 390 meters.

A new RHEOSTAT



with immovable coils

Centralab
ADJUSTABLE GRID LEAK

gives smooth unbroken adjustment over 900 degrees—2½ turns of the knob—and holds the resistance value at which the knob is set.

No. 106—(*without condenser*) . . **$1.25**
No. 107—(*with .00025 condenser*) . . **$1.60**

Centralab
NON-INDUCTIVE POTENTIOMETER

has no wire-wound resistor and assures noiseless operation of the set.

No. 110—400 *ohms* . . **$1.50**
No. 111—2000 *ohms* . . **$1.75**

The coils of the new Centralab Rheostat are made of bright, non-corroding wire, and are firmly clamped between and imbedded in insulating discs so they cannot move. This eliminates the noise in the set caused by lateral movement of coils away from and towards each other as the contact arm passes over them. It also maintains a uniform spacing between windings, giving smooth, even regulation and eliminating dead spots.

The contact arm is made of sturdy, spring tempered phosphor bronze, and is positively locked to the shaft. The contact shoe slides over the resistor at a tangent and cannot catch. The rheostat is attractive in appearance and substantial in construction. All metal parts except wires are of brass, heavily nickel plated. The knob may be adjusted flush with the panel or replaced by any standard dial. Single hole mounting. Firm, positive contacts.

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No. 230—30 ohms resistance **$1.25**
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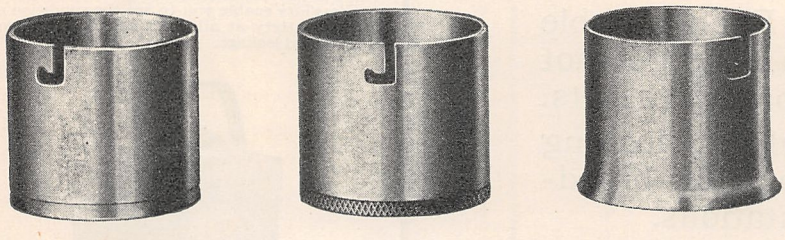

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PRECISION COIL COMPANY
209-D Centre Street New York

KUY El Monte, Calif. Coast Radio Co.
WMAL Trenton, N. J. Trenton Hardware Co.

258 METERS—1162 KILOCYCLES

KFCZ Omaha, Neb. Omaha Central High School.
KFJR Stevensville, Montana. Ashley C. Dixon & Son.
KGY Lacey, Wash. St. Martin's College.
KNV Los Angeles, Calif. Radio Supply Co.
WBBJ West Palm Beach, Fla. Niel Electric Co.
WDBC Lancaster, Penna. Kirk Johnson & Co., Inc.
WFAT Sioux Falls, S. D. New Columbus College.
WHAK Clarksburg, West Virginia. Roberts Hdwe. Co.
WQAL Mattoon, Ill. Coles Co. Telephone & Teleg. Co.
WQAV Greenville, S. C. Huntington & Guerny, Inc.
WSAZ Pomeroy, Ohio. Chase Elec. Shop.
WTAG Providence, R. I. Kern Music Co.

261 METERS—1149 KILOCYCLES

KDZR Bellingham, Wash. The Bellingham Pub. Co.
KFEX Minneapolis, Minn. Augsburg Seminary.
KFHH Neah Bay, Wash. Ambrose A. McCue.
KFLH Salt Lake City, Utah. Erickson Radio Co., Inc.
KFLQ Little Rock, Ark. Bizzell Radio Shop.
KFMR Sioux City, Iowa. Morningside College.
KFNY Helena, Mont. Montana Phonograph Co.
KFOO Salt Lake City, Utah. Latter Day Saints University.
KLN Delmonte, Calif. Monterey Electric Shop.
WABQ Haverford, Pa. Haverford College Radio Club.
WBL Anthony, Kans. T. & H. Radio Co.
WCAY Milwaukee, Wis. Kesslemon O'Driscoll Music House.
WDAK Hartford, Conn. The Courant.
WEW St. Louis, Mo. St. Louis University.
WGAW Altoona, Penna. Ernest C. Albright.
WMAC Cazenovia, New York. C. B. Meredith.
WMU Washington, D. C. Doubleday Hill Elec. Co.
WSAD Providence, R. I. J. A. Foster Co.

263 METERS—1140 KILOCYCLES

KFEV Casper, Wyo. Casper Radio Club.
KFMQ Fayetteville, Ark. Univ. of Arkansas.
KNT Aberdeen, Wash. Gray's Harbor Radio Co.
WAAM Newark, N. J. I. R. Nelson Co.
WABV Nashville, Tenn. John H. DeWitt, Jr.
WCAK Houston, Tex. Alfred P. Daniel.
WCBE New Orleans, La. Uhalt. Radio Co.
WDAG Amarillo, Texas. J. Laurence Martin.
WSAP New York City. City Temple.

265 METERS—1131 KILOCYCLES

WABZ New Orleans, La. The Coliseum Place Baptist Church.

266 METERS—1127 KILOCYCLES

KFHF Shreveport, La. Central Christian Church.
KFMW Houghton, Mich. M. G. Satern.
KFNF Shenandoah, Iowa. Henry Field Seed Co.
WABA Lake Forest, Ill. Lake Forest University.
WABB Harrisburg, Pa. Dr. George B. Lawrence.
WABP Dover, Ohio. Robert F. Weinig.
WCBK St. Petersburg, Fla. E. Richard Hull.
WCBN Harrison, Ind. James P. Boland.
WNAL Omaha, Neb. R. J. Rockwell.
WQAC Lima, Ohio. Maus Radio Co.
WQAS Lowell, Mass. Prince Walter Co.

268 METERS—1119 KILOCYCLES

KFLE Denver, Col. National Educational Service.
KFOP Dallas, Texas. Willson Construction Co.
WAAB New Orleans, La. Valdemar Jensen.
WBBY Charleston, S. C. Washington Light Inft.
WCAG New Orleans, La. Clyde R. Randall.
WDAH El Paso, Texas. Trinity Methodist Church South.
WJAM Cedar Rapids, Iowa. H. F. Paar.
WMAZ Macon, Georgia. Mercer University.
WPAJ New Haven, Conn. Doolittle Radio Corp.
WRAX Gloucester City, N. J. Flaxon's Garage.
WSAT Plainview, Texas. Plainview Electric Co.
WSAX Chicago, Ill. Chicago Radio Laboratory.
WTAF New Orleans, La. Louis J. Gallo.

270 METERS—1110 KILOCYCLES

KDPM Cleveland, Ohio Westinghouse Elec. & Mfg. Co.
KDZE Seattle, Wash. The Rhodes Dept. Store.
KFAU Boise, Idaho. Boise High School Daily.

FADA

Improves the 5-tube Neutrodyne

YES, sir! We've made it better in every way. Improved its looks, improved the circuit, eliminated unnecessary detail in making, and incorporated the latest and best ideas in Neutrodyne efficiency. Letters from ten thousand FADA boosters have helped us work out the new and improved FADA 5-tube Neutrodyne. We've put all binding posts in the rear, simplified the wiring and beautified the panel arrangement. Two stages of radio frequency, detector and two stages of audio frequency amplification (using the new FADA Audio Transformers) make this new FADA Neutrodyne about the best looking and most dependable radio receiver anyone can make. Your dealer sells the new FADA knock-down set of Neutrodyne Receiver Parts No. 169-A for $72. Look for it in his window. With every one goes the new and enlarged edition of

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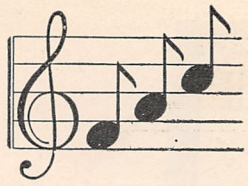

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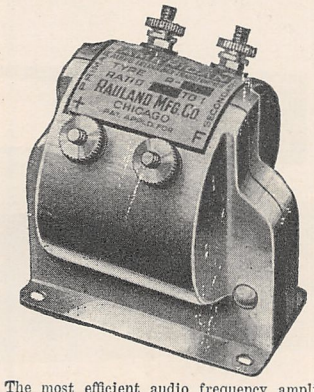
The *naturalness* with which All-American Transformers amplify music or voice, is in no small measure responsible for their outstanding popularity. As the horn of a fine phonograph builds up tone volume without distorting the various sounds introduced into it by the reproducer, so All-American Transformers make more audible, but none the less real and enjoyable, the programs taken from the air. There is *musical* quality to All-American amplification for the reason that All-Americans are designed as musical instruments. Thus they improve the performance of any set.



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The unprecedented success scored by the recently announced All-American Long Wave Intermediate Frequency Transformer (15-75 KC) is shortly to be augmented by an All-American tuned 30-KC radio Frequency Transformer and a new All-American Radio Frequency Coupler also suitable for the Super Heterodyne. Watch for these—and the new All-American Low Wave Radio Frequency Transformers!

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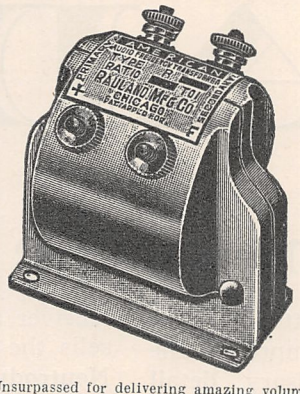

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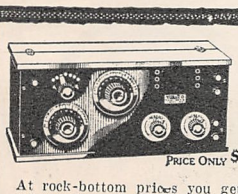

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PERFECT for every CIRCUIT

Simplifies wiring. Eliminates hand rheostats.

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Insure your copy reaching you each month. Subscribe to Radio News—$2.50 a year. Experimenter Publishing Co., 53 Park Place, N. Y. C.

KYQ	Honolulu, H. T.	Electric Shop, Levres & Joaquin Co.
WABR	Toledo, Ohio.	Scott High School.
WABX	Mt. Clemens, Mich.	Henry B. Joy.
WBBF	Atlanta, Ga.	Georgia School of Technology.

273 METERS—1098 KILOCYCES

KFIZ	Fond du Lac, Wis.	Daily Commonwealth.
KFKA	Greeley, Colo.	Colorado State Teachers' College.
KFLZ	Atlantic, Ia.	Atlantic Automoblie Co.
KJQ	Stockton, Calif.	Gould The Light Man.
WEAN	Providence, R. I.	The Shepard Store.
WEB	St. Louis, Mo.	The Benwood Co., Inc.
WFAF	Poughkeepsie, N. Y.	H. C. Spratley Radio Co.
WJH	Washington, D. C.	Wm. P. Boyer Co.
WOAG	Belvedere, Ill.	Apollo Theatre.
WPAZ	Charleston, W. Va.	Dr. John A. Koch.
WRW	Tarrytown, N. Y.	Tarrytown Radio Research Lab.
WSL	Utica, N. Y.	J. & M. Electric Co.
WWI	Dearborn, Mich.	Ford Motor Co.

275 METERS—1090 KILOCYCLES

KFFY	Alexandria, La.	Pincus & Murphy, Inc.
KFHS	Lihue, Hawaii.	Clifford J. Dow.
KFMS	Duluth, Minn.	Freimuth Dept. Store.
KRE	Berkeley, Calif.	Daily Gazette
WABG	Jacksonville, Fla.	Arnold Edwards Piano Co.
WBBN	Wilmington, N. C.	A. B. Blake.
WFAV	Lincoln, Neb.	University of Nebraska.
WMAJ	Kansas City, Mo.	Kansas City Daily Drovers Telegram.
WNAP	Springfield, Ohio.	Wittenberg College.
WQAE	Springfield, Vt.	Moore Radio News Station.
WSAW	Canandaigua, N. Y.	John Long, Jr.

278 METERS—1078 KILOCYCLES

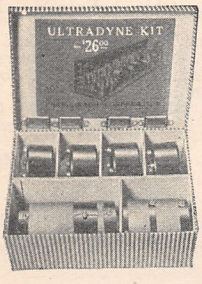
KDZF	Los Angeles, Calif.	Auto. Club of So. California.
KFBC	San Diego, Calif.	W. K. Azbill.
KFFX	Omaha, Neb.	The McGraw Co.
KFSG	Los Angeles, Calif.	
WDZ	Tuscola, Ill.	James L. Bush.
WIAK	Omaha, Neb.	Daily Journal Stockman.
WNAC	Boston, Mass.	The Shepard Stores.

280 METERS—1071 KILOCYCLES

KDYM	San Diego, Calif.	Savoy Theater.
KFAR	Hollywood, Calif.	Studio Lighting Service Co.
KFAW	Santa Anna, Calif.	Radio Den.
KFHB	Hood River, Ore.	Rialto Theater.
KFJM	Grand Forks, N. D.	University of North Dakota.
KFJQ	Grand Forks, N. D.	Valley Radio Div. of Elec. Cons. Co.
WCAD	Canton, N. Y.	St. Lawrence University.
WCAS	Minneapolis, Minn.	Wm. H. Dunwoody Industrial Inst.
WBCA	Allentown, Penna.	Chas. W. Heimback.
WCBC	Ann Arbor, Mich.	University of Michigan.
WCBL	Houlton, Me.	Northern Radio Mfg. Co.
WEAA	Flint, Mich.	Frank D. Fallain.
WEAH	Wichita, Kans.	Wichita Board of Trade.
WHAD	Milwaukee, Wis.	Marquette University.
WJAN	Peoria, Ill.	Peoria Star.
WKAR	East Lansing, Mich.	Michigan Agricultural College.
WKAY	Gainesville, Ga.	Breneau College.
WMAY	St. Louis, Mo.	Kingshighway Presbyterian Church.
WQAN	Scranton, Penna.	Radio Sales Corp.
WTAR	Norfolk, Va.	Reliance Electric Co.
WTAW	College Station, Texas.	Agri. & Mech. College of Texas.
WWL	New Orleans, La.	Loyola University.

283 METERS—1060 KILOCYCLES

KFBK	Sacramento, Calif.	Kimbal Upson Co.
KFBU	Laramie, Wyoming.	Bishop N. S. Thomas.
KFHR	Seattle, Wash.	Star Electric & Radio Co.
KFKV	Butte, Mont.	F. F. Gray.
KFLA	Butte, Mont.	Abner R. Wilson.
KFMX	Northfield, Minn.	Carleton College.
KFOH	Portland, Ore.	Radio Bungalow.
KFZ	Spokane, Wash.	Doerr Mitchell Elec. Co.
KJR	Seattle, Wash.	Northwest Radio Service Co.
WABD	Dayton, Ohio.	Parkin High School.
WABE	Washington, D. C.	Y. M. C. A.
WABL	Storrs, Conn.	Connecticut Agricultural College.
WBBL	Richmond, Va.	Grace Covenant Presb. Church.
WEAJ	Vermillion, S. D.	Univ. of South Dakota.
WHAH	Joplin, Mo.	Hafer Supply Co.
WHAM	Rochester, N. Y.	University of Rochester.



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The Ultraformers are new improved long wave radio frequency transformers, especially designed by R. E. Lacault, A.M.I.R.E., Consulting Engineer of this company and inventor of the Ultradyne.
To protect the public, Mr. Lacault's personal monogram seal (R.E.L.) is placed on all genuine Ultraformers. Ultraformers are guaranteed so long as this seal remains unbroken.

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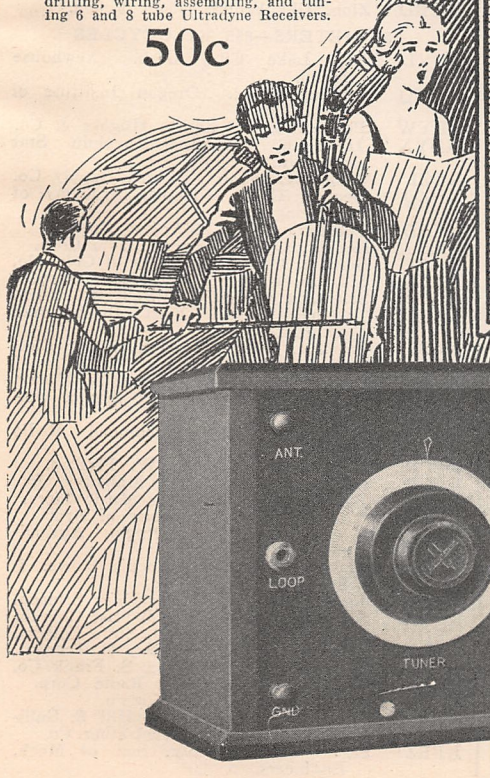

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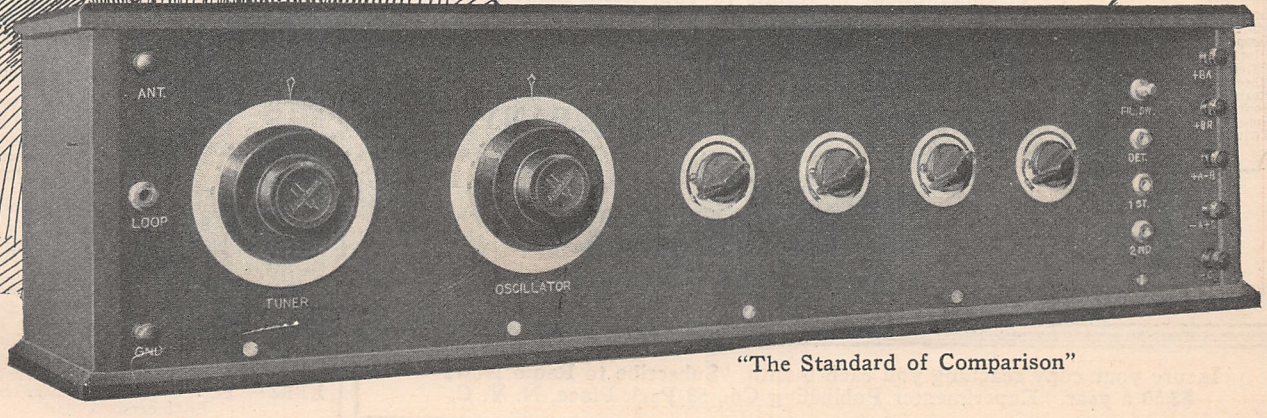

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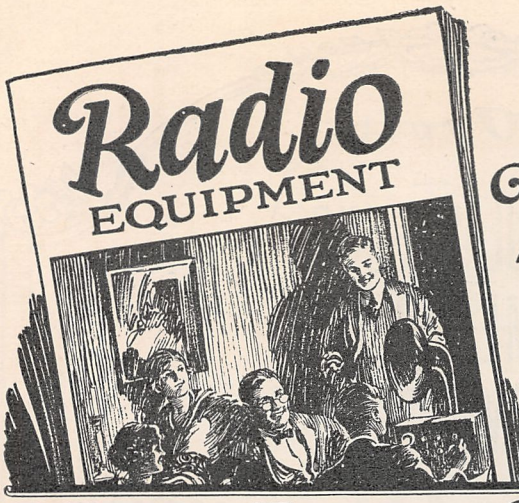

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Condensers, variable
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WHK Cleveland, Ohio. Warren R. Cox.
WJAG Norfolk, Nebr. Norfolk Daily News.
WOAP Kalamazoo, Mich. Kalamazoo College.
WPAB State College, Pa. Pennsylvania State College.
WQAM Miami, Fla. Electrical Equip. Co.
WTAY Oak Park, Ill. Oak Leaves.
WTAZ Lambertville, New Jersey. Thos. J. McGuire.

286 METERS—1048 KILOCYCLES

KFKB Milford, Kans. Brinkle-Jones Hospital Assn.
KOP Detroit, Mich. Detroit Police Dept.
WAAF Chicago, Ill. Chicago Daily Drovers Journal.
VBR Butler, Penna. Pennsylvania State Police.
WCAH Columbus, Ohio. Eutrekin Electric Co.
WCAU Philadelphia, Pa. Durham & Co.
WEAI Ithaca, N. Y. Cornell University.
WEAM North Plainfield, N. J. Borough of N. Plainfield.
VMAN Columbus, Ohio. First Baptist Church.
WNAN Syracuse, N. Y. Syracuse Radio Telephone Co.
WPAL Columbus, Ohio. Superior Radio & Tel. Equip. Co.
WTAS Elgin, Ill. Chas. E. Erkstein.

294 METERS—1020 KILOCYCLES

KFGZ Berrien Springs, Mich. Emanuel Missionary Col.

309 METERS—970 KILOCYCLES

WLW Cincinnati, Ohio. Crosley Mfg. Co.
WSAI Cincinnati, Ohio. U. S. Playing Card Co.

310 METERS 967 KILOCYCLES

CHCE Victoria, B. C. West. Canada Radio Supply Co.

312 METERS—961 KILOCYCLES

KGO Oakland, Cailf. General Elect. Co.

314 METERS—955 KILOCYCLES

CJCM Mont Joli, P. Q. Dr. J. L. P. Landry.

319 METERS—940 KILOCYCLES

WGR Buffalo, N. Y. Federal Tel. & Teleg. Co.

326 METERS—920 KILOCYCLES

KDKA Pittsburgh, Pa. Westinghouse Elec. & Mfg. Co.

330 METERS—908 KILOCYCLES

KFAE Pullman, Wash. State College of Wash.

337 METERS—890 KILOCYCES

WBZ Springfield, Mass. Westinghouse Elec. & Mfg. Co.

341 METERS—880 KILOCYCLES

CHYC Montreal, Que. Northern Elec. Co.
KFKX Hastings, Neb. Westinghouse Elec. & Mfg. Co.

345 METERS—869 KILOCYCLES

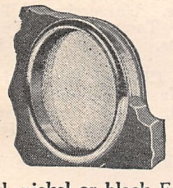
WCBD Zion, Ill. Wilbur Glenn Voliva.

360 METERS—833 KILOCYCLES

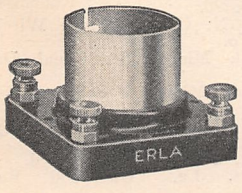
KDYL Salt Lake City, Utah. Newhouse Hotel.
KDYQ Portland, Ore. Oregon Institute of Technology.
KDYW Phoenix, Ariz. Smith, Hughes & Co.
KDYX Honolulu, Hawaii. Honolulu Star Bulletin.
KDZI Wanetche, Wash. Electric Supply Co.
KDZQ Denver, Colo. Nicholas Academy of Dancing.
KFAD Phoenix, Ariz. McArthur Bros.
KFAF Denver, Colo. Western Radio Corp.
KFAJ Boulder, Colo. Universtiy of Colorado.
KFAN Mascon, Idaho. The Electric Shop.
KFBE San Luis Obispo, Calif. R. H. Horn.
KFBG Tacoma, Wash. First Presbyterian Church.
KFBS Trinidad, Colo. Trinidad Gas & Elec. Supply Co.
KFCF Walla Walla, Wash. Frank A. Moore.
KFCH Billings, Mont. Electric Service Station.
KFCM Richmond, Calif. Richmond Radio Shop.
KFCP Ogden, Utah. Ralph W. Flygars.
KFCV Houston, Texas. Fred Mahaffey, Jr.
KFDA Baker, Oregon. Adler's Music Store.
KFDH Tucson, Ariz. University of Ariz.
KFDJ Corvallis, Oregon. Oregon Agricultural College.
KFDR York, Nebraska. Bullock's Hdwe. & Sporting Goods Store.
KFDV Fayetteville, Ark. Gilbrech & Stinson.
KFDX Shreveport, La. First Baptist Church.
KFDY Brookings, S. D. S. D. State College.
KFDZ Minneapolis, Minn. Harry O. Iverson.
KFEC Portland, Oregon. Meier S. Frank Co.
KFEL Denver, Colo. Winner Radio Corp.
KFEQ Oak, Neb. J. L. Scroggin.
KFEY Kellog, Idaho. Bunker Hill & Sullivan Mining & Concentrating Co.
KFEZ St. Louis. Mo. Am. Soc. of Mech. Engineers.

"the superior tone quality of Erla Duo-Reflex circuits, as well as their unmatched range and volume, stamp them as the most advanced types yet developed"

Erla Selectoformer imparts to novices expert skill in tuning, easily bringing in long range signals through local interference. List $5

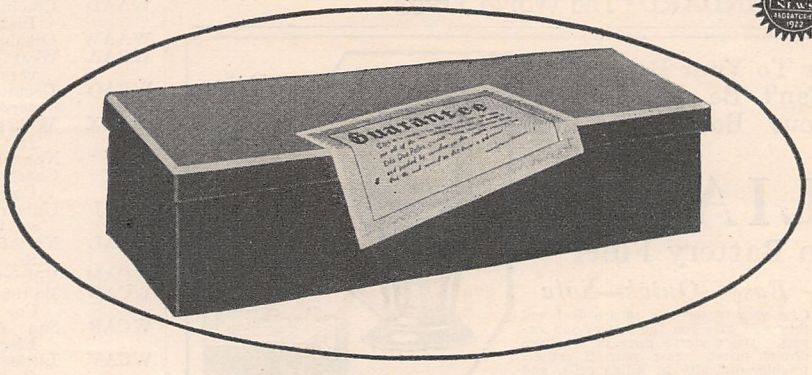


Gold, nickel or black Erla bezels enhance any receiving set 100%. Telescoping patented rim fits ⅛" to ¼" thick panels. List, 20c-30c



Wiping contact of diagonal, tilted springs exclusive to Erla sockets assures clean, positive engagement, eliminating current loss. 65c-75c

Erla fixed crystals embody permanently correct rectification-resistance ratio so essential to success in reflex work. List price, $1.00



FACTORY sealed cartons of complete parts now make child's play of assembling Erla Duo-Reflex circuits, tube for tube, the most powerful ever built.

Synchronizing reflex and audio transformers, tested capacity condensers, balanced crystals, these and other factory packaged units remove all doubt as to selection of proper materials, while correct construction is made equally certain through a stenciled baseboard, drilled and lettered panel, and full-size blueprints giving the exact location of every nut, screw and wire.

For tools, only pliers and a screwdriver are needed. Soldering is eliminated by Erla solderless connectors.

Examine a completed Erla demonstrating receiver at your nearest dealer's. See how easy it is to build. Then make yourself a duplicate in a few hours' time. Your dealer will gladly co-operate. Or get in touch with us direct, giving your dealer's name.

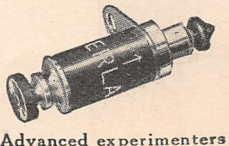
Electrical Research Laboratories, Dept. C, Chicago

ERLA

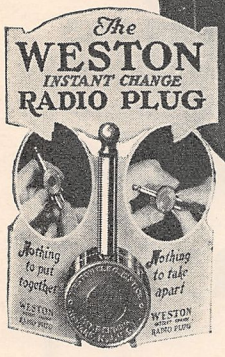
Erla reflex transformers alone amplify at maximum both received and reflexed radio frequency currents, without distortion. List $5

Unique ability to amplify three stages without trace of distortion proves conclusively the superiority of Erla audios. List price, $5

The words "tested capacity" found exclusively on Erla fixed condensers, guarantee accuracy unapproached. Made in 11 sizes, 30c to 75c ea.



Advanced experimenters find Erla semi-fixed crystals a most scientific means for balancing perfectly their pet hook-up. List price, $1.00



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Radio Battery Filler

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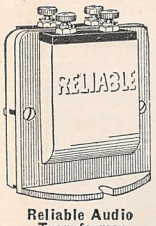

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Another Necessity! A Reliable Battery Tester with yourReliable Battery Filler and charger make a complete service station in your home.

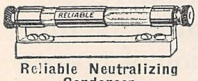
For cleaner reception and greater audibility.

Clear the air of all disturbances "cat-calls" etc., with this device.

Easy—Quick—Safe

Give your batteries a square deal and they will give you the service you expect. Don't starve them or let them die of thirst. Save yourself endless trouble, difficulty in filling cells, and slow-poke work by using the Reliable Battery Filler. Carry it anywhere. No slopping, overflowing, loss of electrolyte or unnecessary labor. Can be used for "A", "B" and automobile batteries.

Write for circular explaining use of this device and How To Care For Your Batteries.



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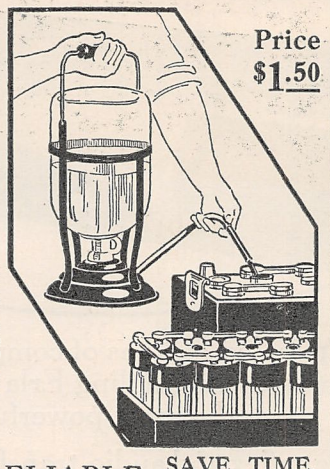

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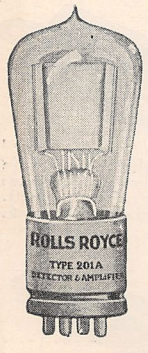

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Range 500 to 1,000 miles

$18.50
Without Tube, Phones or Batteries

HERE is the New MONODYNE **"Baby Grand"** outfit which fills every requirement necessary to enjoy all radio broadcast entertainment.

From its conception, the MONODYNE was marketed as a single unit so that batteries and headphones remained exposed in the open. To meet an incessant demand, we designed a new cabinet, provided with compartments for all accessories and which outfit we take pleasure in presenting herewith.

The MONODYNE **"Baby Grand"** has a beautifully designed compact wooden cabinet finished in leatherette throughout. The connections are all wired, —ready for batteries, aerial and ground. A hinged cover with snap-lock protects the entire apparatus from dust. Cover specially provided with a broad flexible leather strap for vacuum tube. The cabinet is also provided with two compartments for phones, "A" and "B" batteries.

The original MONODYNE unit, Model GT2, of which tens of thousands are now in use all over the country, are still giving the highest of satisfaction in efficiency and long distance reception. Good as the old MONODYNE is, we have embodied a number of far-reaching improvements which makes the MONODYNE **"Baby Grand"** incomparably better.

The MONODYNE **"Baby Grand"** is a tuned radio frequency detector and amplifier, which receives radio broadcast clear and loud without distortion over an average radius of 500 miles. Good reception over a radius of 1,000 miles has been frequently obtained.

The MONODYNE **"Baby Grand"** has ONLY ONE TUNING KNOB. Stations always come in on the same point on the dial. In addition it now is equipped with a new *Volume Control* permitting fine adjustments for long distance reception.

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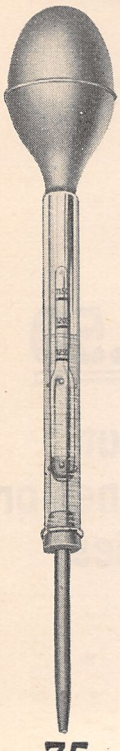

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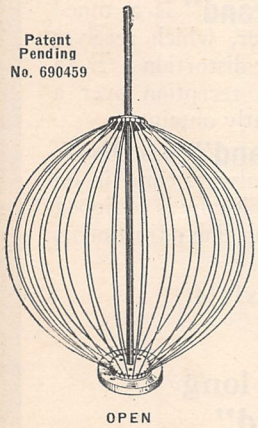

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Send in your order now. Be among the first to show your friends the latest and greatest improvement in radio.

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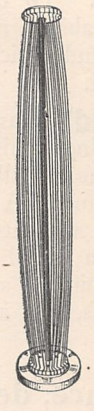

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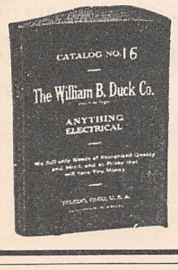

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WOQ	Kansas City, Mo.	Western Radio Co.
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WPAC	Okmulgee, Okla.	Donaldson Radio Co.
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WPAM	Topeka, Kan.	Auerbach & Guettel.
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WSAB	Cape Girardeau, Mo.	So. East State Teachers' College.
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WSAJ	Grove City, Pa.	Grove City College.
WSY	Birmingham, Ala.	Alabama Power Co.
WTAC	Johnstown, Pa.	Pennsylvania Traffic Co.
WTAU	Tecumseh, Neb.	Reugg Battery & Elec. Co.
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WWAD	Philadelphia, Pa.	Wright & Wright, Inc.

370 METERS—810 KILOCYCLES

CYB	Mexico City, Mexico.	El Buen Tono.
WGN	Chicago, Ill.	Chicago Tribune & Chicago Radio Lab.

380 METERS—789 KILOCYCLES

WGY	Schenectady, N. Y.	General Electric Co.
WHAZ	Troy, N. Y.	Renssalaer Polytechnic Inst.

385 METERS—780 KILOCYCLES

WOAI	San Antonio, Texas.	Southern Equip. Co.

390 METERS—768 KILOCYCLES

WBAV	Columbus, Ohio.	The Ernor Hopkins Co.
WJAX	Cleveland, Ohio.	Union Trust Co.
WTAM	Cleveland, Ohio.	Willard Storage Battery Co.

THE NEW MODEL C-7 SUPER-HETERODYNE

Important Today

THE EXPERIMENTERS INFORMATION SERVICE, Inc., has been recommending the Super-Heterodyne method of reception since the early part of 1922. In February, 1923, a Super-Heterodyne of our design was installed on the *S.S. Western World,* pier 1, Hoboken, N. J., in the cabin of Dr. Horatio Belt. On the voyage to Rio de Janeiro, Brazil, at a distance of 3,000 miles, southeast of New York, the entire Greb-Gardner fight was received from WJZ, with sufficient audibility for the entire cabin full of passengers to hear the bout, blow by blow, plainly. At 3,300 miles southeast of New York, an entire evening church service was received from Pittsburgh. At that time there was not another single firm advertising or advocating the Super-Heterodyne. Since then Mr. A. Ancieux, Engineer, Trarivia Elec de Arequipa, Arequipa, Peru, has reported consistent reception from KDKA, WDAP, WEAF, WGY and others, a distance of over 5,000 miles, using a Model "C" Super-Heterodyne. The Pratt & Blake Corp., of New York City, sent a Model C to Rio de Janeiro which received American broadcast station at a distance of over 7,000 miles.

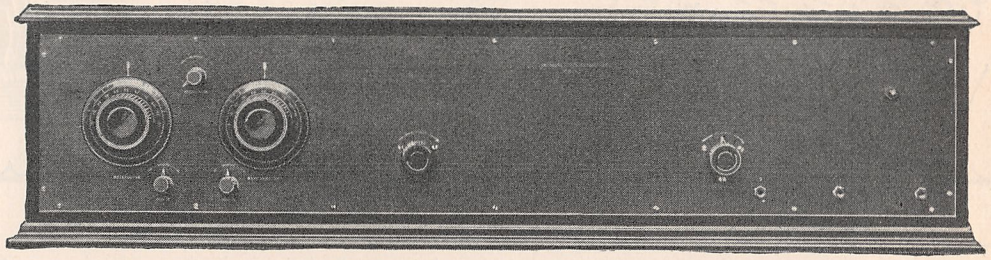
Practically all concerns now featuring Super-Heterodyne have copied our original Model C design, and to prove again that we are far in advance of competition, we present this Improved Model C-7 Super-Heterodyne as the *Most Sensitive, Most Selective,* and finest reproducing Broadcast Receiver that can be built.

7 Tubes Give the Results of 10

The Reason:—When regeneration is added to a one tube non-regenerative receiver, the increased amplification is about equal to adding two stages of tuned radio frequency amplification. Heretofore it has been impossible to add regeneration in the 1st Detector of a Super-Heterodyne and accordingly this has been a big loss.

The new Model C-7 Super-Heterodyne has a special 1st Detector circuit with a split antenna inductance so arranged that normally the detector would oscillate continually. However, in addition, a neutralizing condenser is inserted in the circuit which gives absolute control of the oscillations to such an extent that the circuit can be adjusted to just below the oscillating point, as this adjustment gives the maximum regenerative amplification. The new circuit has a bias potential on the 1st Detector grid, in place of the usual grid leak and condenser, and this allows infinitely weak signals to be regenerated and heterodyned through the radio frequency amplifier, which an ordinary grid leak and condenser would block. On a weak signal the difference in sensitivity is very noticeable. Using a 22-foot indoor antenna in the suburbs of New York loud speaker reception has been obtained from KGO, Oakland, California. A normal range of 2000 miles is easily obtained on an average small antenna at night under average conditions.

"The Rolls-Royce of Reception"



MODEL C-7 SUPER-HETERODYNE

Wave-length Range, 200 to 575 meters. Dimensions, 40 in. x 8 in. x 8 in.
Tube Arrangement: Regenerative Detector, Oscillator, 2 Stages Radio, Detector, 2 Stages Audio.

General Information

ANTENNA: Single wire, 30 to 150 feet long. Provision has been made for use of either a short or long antenna. Indoor antenna works very satisfactory.

TUBES: 7 Radiotrons UV201A or C201A, requiring one 6 volt storage battery and one 90 volt B Battery either dry or storage.

DRY CELL TUBES: Radiotrons UV199 or C199 may be used if desired, but the results obtained with dry cell tubes are not as satisfactory as with the Radiotrons UV201A or C201A.

LOOP: As a loop takes considerable space and is objectionable looking, and furthermore an inefficient collector, no provision has been made for loop reception. Local reception can be had without antenna or ground. An indoor antenna 30 to 50 feet long is suggested in place of a loop.

SELECTIVITY: The degree of selectivity is so high that distance stations can easily be tuned in through the local stations. For example, with a C-7 located five miles from WJZ operating on 455 meters, WCAE Pittsburgh on 462 meters can be tuned in without interference with WJZ.

TUNING: There are only two tuning adjustments, one for the detector circuit and one for the oscillator. Each station has a definite point on each dial and will always be found at these calibrations. Individual Verniers are provided for each dial. A third Vernier controls the volume.

CONSIDERATIONS: The Second Harmonic feature could be used with a view to eliminating another tube, but we feel that the many advantages of having a separate oscillator more than compensates for the extra tube. For a similar reason we have refrained from Reflexing the circuit to reduce the number of tubes.

STANDARDIZATION: All the component parts specified are readily obtainable on the market through high-class dealers.

PARTS: The parts specified in this design are all selected with expert consideration with a view to giving the maximum results obtainable. While it may appear that certain other parts could be used to economize, we strongly recommend that you take advantage of our engineering experience and follow the specifications to the letter.

Original Blue Print showing all data, diagrams, circuits, details, etc., **$1.00**, postpaid

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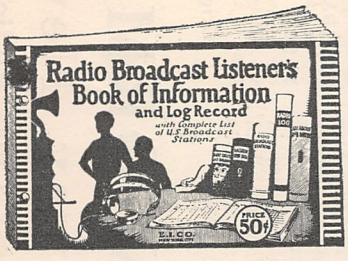

Can you tally offhand how many stations you have received or do you keep a bulky book record somewhere? Here's a handsome Log Record and Book of Information to keep your Radio's performance. Keep it always in sight, show it to your friends when they visit you. It's a book to be proud of.

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395 METERS—759 KILOCYCLES

KHJ	Los Angeles, Calif.	Los Angeles Times.
WDAR	Philadelphia, Pa.	Lit Bros. Club.
WFI	Philadelphia, Pa.	Strawbridge & Clothier.

400 METERS—749 KILOCYCLES

AV7	St. Paul, Minn.	6 Inft. Minn. Nat. Guard.
CFCA	Toronto, Ont.	Toronto Star.
CFCH	Iroquois Falls, Ont.	Abitibi Power & Paper Co.
CFCL	Victoria, B. C.	Centennial Methodist Church.
CFQC	Saskatchewan, Sas.	The Electric Shop, Ltd.
CFUC	Montreal, Que.	University of Montreal.
CHAC	Halifax, N. S.	Radio Engineers.
CHCE	Victoria, B. C.	Western Canada Radio Supply Co., Ltd.
CJCI	St. Johns, N. B.	Maritime Radio Corp.
CJCX	Olds, Alberta.	Percival W. Shackleton.
PWX	Havana, Cuba.	International Tel. & Teleg. Corp.
WBAK	Harrisburg, Pa.	Pennsylvania State Police.
WHAS	Louisville, Ky.	Courier Journal & Louisville Times.

405 METERS—740 KILOCYCLES

WJY	New York City.	Radio Corp. of America.
WOR	Newark, N. J.	L. Bamberger & Co.

406 METERS—738 KILOCYCLES

WAR	Sisiht, Wis.	Kopp Radio Co.

410 METERS—731 KILOCYCLES

CFCJ	Quebec, Que.	La Ciede L'Evenement.
CFCK	Edmonton, Alta.	Radio Supply Co.
CFCR	Sudbury, Ont.	Laurentida Air Service, Ltd.
CHBC	Calgary, Alta.	The Alberta Publishing Co.
CHCD	Quebec, Que.	Canadian Wireless & Elec. Co.
CJCD	Toronto, Ont.	T. Eaton Co.
CJCN	Toronto, Ont.	Simons, Agnew & Co.
CKCD	Vancouver, B. C.	Vancouver Daily Province.
CKOC	Hamilton, Ont.	Wentworth Radio Supply Co., Ltd.

411 METERS—729 KILOCYCLES

WDAF	Kansas City, Mo.	Kansas City Star.
WHB	Kansas City, Mo.	Sweeney Auto & Electric School.

417 METERS—719 KILOCYCLES

WBAH	Minnepaolis, Minn.	The Dayton Co.
WLAG	Minneapolis and St. Paul, Minn.	Cutting & Washington Radio Corp.

420 METERS—714 KILOCYCLES

CFCW	London, Ont.	The Radio Shop.
CJCE	Vancouver, B. C.	Spratt-Shaw Radio Co.
CKCK	Regina, Alaska.	Leader Publishing Co.

421 METERS—712 KILOCYCLES

KIAF	Sihtipoc, Minn.	Steel Co.

423 METERS—711 KILOCYCLES

KPO	San Francisco, Calif.	Hale Bros., Inc.

425 METERS—705 KILOCYCLES

AQ6	Canton, Ohio.	Hdqtrs. 135th Field Art., Ohio National Guard.
CKAC	Montreal, Que.	La Presse.

429 METERS—699 KILOCYCLES

WSB	Atlanta, Ga.	Atlanta Journal.

430 METERS—697 KILOCYCLES

CFAC	Calgary, Alta.	Calgary Herald.
CFDC	Nanaimo, B. C.	Sparks Co.
CJGC	London, Ont.	London Free Press.
CJSC	Toronto, Ont.	The Evening Telegram.

435 METERS—690 KILOCYCLES

CKCH	Ottawa, Ont.	Canadian National Railway.
NAA	Radio, Va.	U. S. Navy Dept.

440 METERS—681 KILOCYCLES

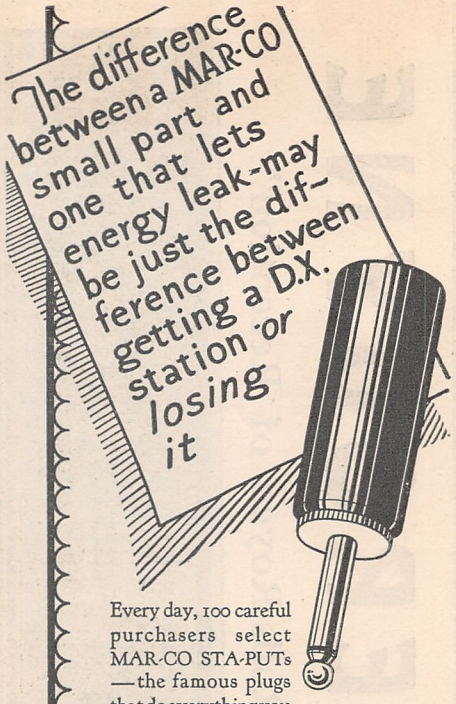
AA3	Denver, Colo.	Fitzsimmons General Hospital.
CFCF	Montreal, Que.	Marconi Wireless Teleg. Co.
CFCN	Calgary, Alta.	W. W. Grant Radio, Ltd.
CHCL	Vancouver, B. C.	The Vancouver Merchants Exch., Ltd.
CHCM	Calgary, Alta.	Riley & McCormick, Ltd.
CKCX	Calgary, Alta.	P. Burns & Co., Ltd.

441 METERS—680 KILOCYCLES

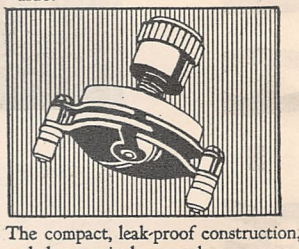
WOS	Jefferson City, Mo.	Missouri State Marketing Bureau.

448 METERS—670 KILOCYCLES

WMAQ	Chicago, Ill.	The Chicago Daily News.



Every day, 100 careful purchasers select MAR-CO STA-PUTs—the famous plugs that do everything you expect, yet cost but 40 cents! Now improved and strengthened, STA-PUT is the outstanding plug value!



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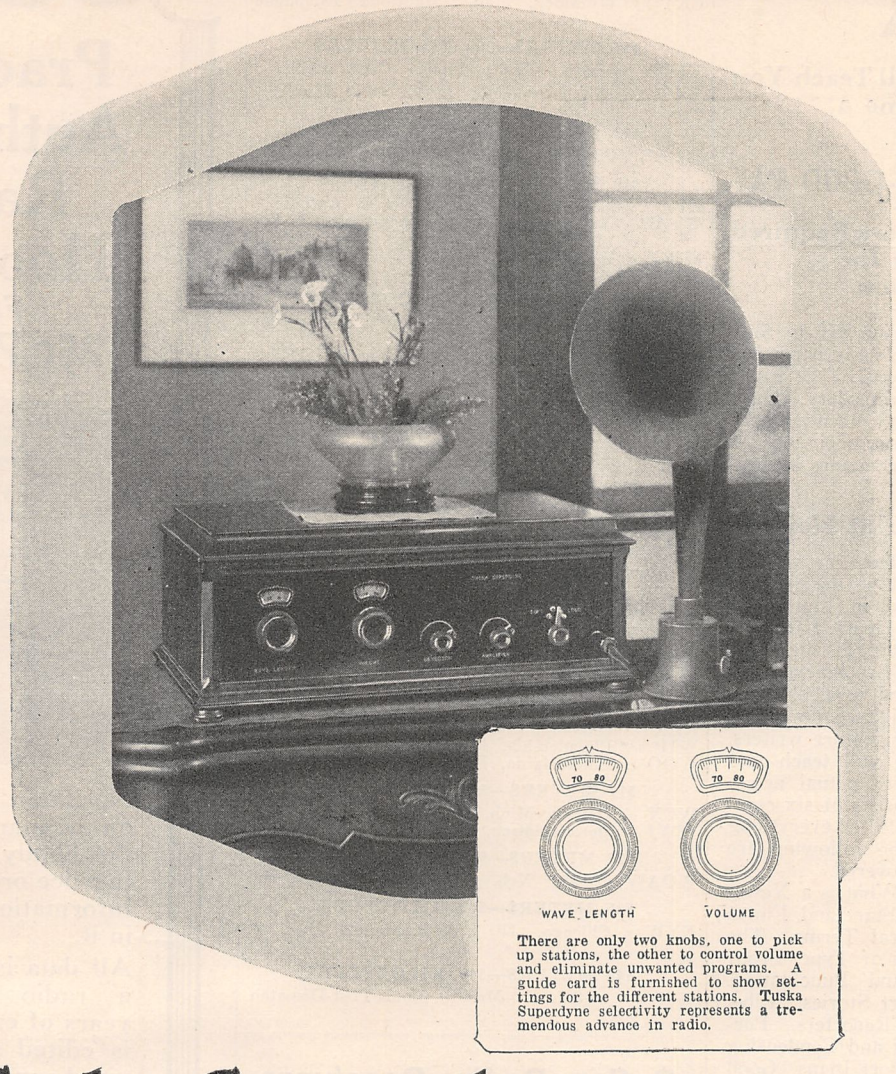
TUSKA RADIO



There are only two knobs, one to pick up stations, the other to control volume and eliminate unwanted programs. A guide card is furnished to show settings for the different stations. Tuska Superdyne selectivity represents a tremendous advance in radio.

Tuska Superdyne

what's in this name?

SO MANY new and unusual names! What do they all mean? "Dyne" comes from a Greek word meaning power, and is used by scientists to-day to indicate force. The Tuska Superdyne is a scientific instrument, precision-built to handle radio energy with superior accuracy, with supersensitivity, with supreme simplicity. What could be more appropriate than "Superdyne"?

This unique receiver is C. D. Tuska's exclusive development of a basic principle to super-excellence. For thirteen years the name Tuska has stood for fine radio apparatus, and to-day it means more than ever. Tuska receivers made years ago are as good now as ever, giving daily pleasure to their owners.

Your set, the one you buy to-day, should be your proud possession for years to come. Be sure it is the Tuska Superdyne. Only four tubes are used. That means economy. You operate only two dials. That means simplicity. And tests show this receiver to exceed the results of sets using more tubes. That means extraordinary efficiency.

Your Tuska Superdyne will thrill you for years.

THE C. D. TUSKA CO., Hartford, Conn.

Nine Times Across the Country

"Eighty-nine stations were heard with the Tuska Superdyne in one month; the actual number of days on which we listened was twenty-one. The greatest jump—Los Angeles—was made probably eight or nine times in two weeks; as a usual thing, any time the attempt was made."

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Asbury Park, N. J.

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The Superdyne Radio Frequency Receiver

The model illustrated above is priced at $150, without tubes, batteries or horn. Great for loud speaker reception of distant stations. Full, natural tone. Licensed under Armstrong Circuit Patent No. 1,113,149. Other Tuska receivers from $35 to $350.

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450 METERS—666 KILOCYCLES

CFCO	Bellevue, Que.	Semmelhaack-Dickson, Ltd.
CFCQ	Vancouver, B. C.	Radio Specialties, Ltd.
CFRC	Kingston, Ont.	Queens University.
CKCE	Toronto, Ont.	Canadian Ind. Telephone Co.
CKY	Winnipeg, Man.	Manitoba Telephone Co.

455 METERS—659 KILOCYCLES

KFOA	Seattle, Wash.	Rhodes Dept. Store.
WJZ	New York City.	Radio Corp. of America.

462 METERS—649 KILOCYCLES

WCAE	Pittsburgh, Pa.	Kaufman & Baer Co.

469 METERS—640 KILOCYCLES

KFI	Los Angeles, Calif.	Earl C. Anthony.
WCAP	Washington, D. C.	Chesapeake & Potomac Tel. Co.
WRC	Washington, D. C.	Radio Corp. of America.

476 METERS—630 KILOCYCLES

WBAP	Fort Worth, Texas.	Fort Worth Star Telegram.
WFAA	Dallas, Texas.	Dallas News and Dallas Journal.

484 METERS—619 KILOCYCLES

WHAA	Iowa City, Iowa.	University of Iowa.
WOC	Davenport, Iowa.	Palmer School of Chiropractic.

492 METERS—609 KILOCYCLES

KGW	Portland, Ore.	Oregonian Publishing Co.
WBAY	New York City.	Western Electric Co.
WEAF	New York City.	American Tel. & Teleg. Co.

500 METERS—599 KILOCYCLES

CYL	Mexico City, Mex.	La Casa de Radio.
CYX	Mexico City, Mex.	Excelsior-Parker.
WMC	Memphis, Tenn.	The Commercial Appeal.

509 METERS—590 KILOCYCLES

KLX	Oakland, Calif.	Oakland Tribune.
WIP	Philadelphia, Pa.	Gimbel Bros.
WOO	Philadelphia, Pa.	John Wanamaker.

517 METERS—580 KILOCYCLES

WCX	Detroit, Mich.	Detroit Free Press.
WWJ	Detroit, Mich.	Detroit News.

526 METERS—570 KILOCYCLES

WOAW	Omaha, Neb.	Woodmen of the World.

536 METERS—560 KILOCYCLES

KYW	Chicago, Ill.	Westinghouse Elec. & Mfg. Co.

546 METERS—549 KILOCYCLES

KSD	St. Louis, Mo.	St. Louis Post-Dispatch.

Reflex Radio Receivers in Theory and Practice

(*Continued from page* 321)

from the plate circuit. Across the secondary L_4 are connected the crystal detector D and the primary T_1 of the step-up transformer T_1 T_2, which is of a type generally known as step-up inter-tube transformers. The primary T_1 may be shunted by a condenser C_4 of .002 mfd. capacity, and is often done when a crystal detector is being used. The secondary T_4 is connected in the grid circuit of the tube V_1, the condenser C_5 acting as a short circuit of T_2 in so far as radio-frequency currents are concerned.

RADIO FREQUENCY POTENTIALS

The radio-frequency potentials communicated to the grid G_1 of a tube V_1 are amplified by the tube, the amplified currents passing through L_3 and being passed on by inductive coupling to L_4; the oscillations in L_4 are detected by the crystal detector D and pulses pass through the primary T_1 of the A. F. transformer T_1. Currents of an alternating nature are produced in the secondary T_2, and as the right-hand side of T_2 is connected to the filament, and the left-hand side is connected through the inductance L_2 to the grid,

100

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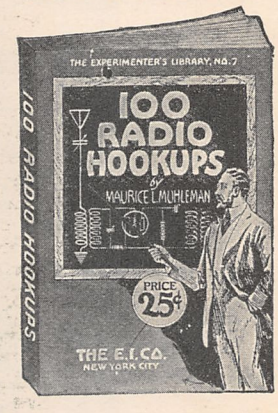

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GOLDEN-LEUTZ SUPER PLIODYNE-9 TRADE MARK REG.

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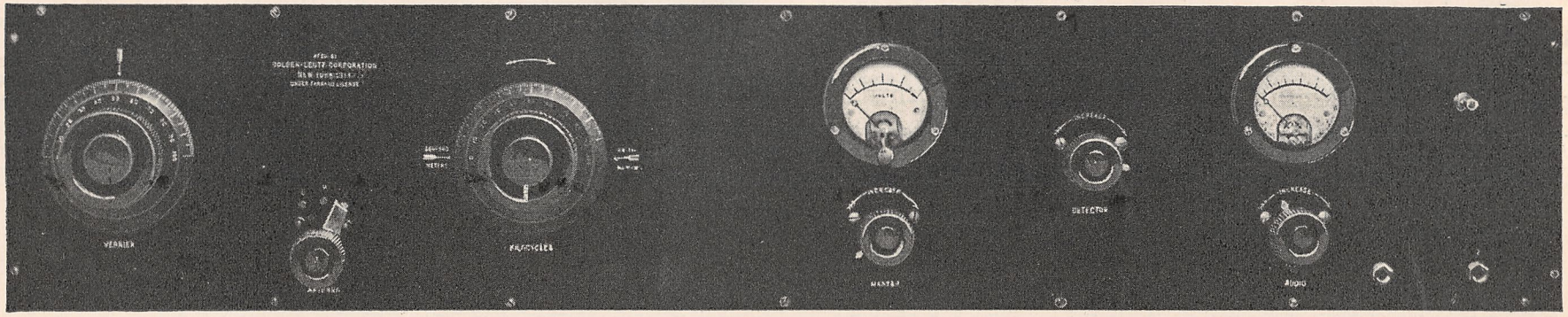

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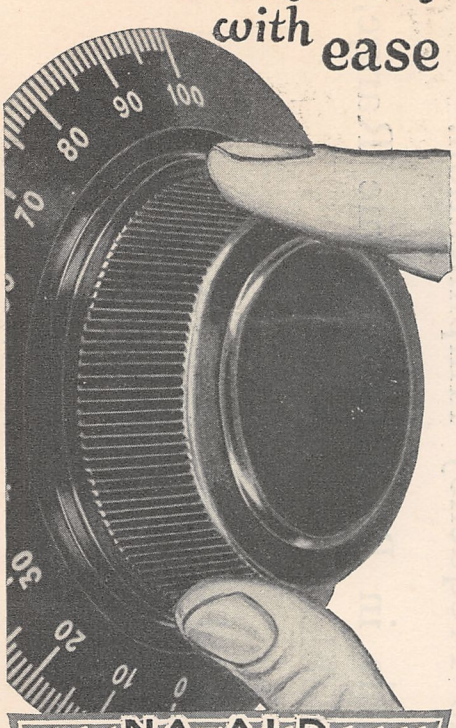

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Shorter intermediate lines, numerals on the bevel and a generous knob are the reasons.

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ALDEN MANUFACTURING CO.
Springfield, Massachusetts
DEPT. K

NA-ALD

the audio-frequency currents are applied to the grid. The audio-frequency potentials applied to the grid now cause large audio-frequency variations in the plate current of the tube, and these pass through the head-phones T and operate them. As L_3 L_4 is an air-core transformer and the coupling, as regards audio-frequency currents, is extremely weak, no audio-frequency currents will be passed into the detector circuit. It is also hardly necessary to point out that the radio-frequency currents passing in the plate circuit of the tube will in no way affect the head-phones T, which will only respond to the amplified audio-frequency currents produced after rectification.

There are several points of design which have been observed even in the simple circuit of Fig. 10. It may be useful to point these out. In the first place, it will be noticed that the filament rheostat R_1 is connected in the negative lead to the filament—*i.e.*, the rheostat is connected between the negative terminal of the "A" battery and one side of the filament. The effect of this is that when the rheostat is in circuit, the current through the filament and through the rheostat will produce a drop of potential across the latter which may amount to 1 volt. The effect of this is that the negative terminal of the "A" battery B_1 is at —1 volt potential with respect to the negative end of the filament F_1. It will be noticed that the right-hand side of T_2 is connected to the negative terminal of B_1. The result is that the grid G_1 is given a normal operating potential of about —1 volt. This is highly desirable, because the tube acts purely as an amplifier in the Fig. 10 circuit; it amplifies both radio- and audio-frequency currents, but in both cases it is mighty desirable to avoid the establishment of grid current due to the grid becoming positive with respect to the negative end of the filament. By keeping the grid at a negative potential, grid currents will only be set up when the signals are very strong. By this little device distortion due to damping of the positive half-cycles of current, and consequent rectification, are avoided. If a larger negative potential is required a small "grid battery" is connected at the point X in the circuit so that some such operating point as B in Fig. 8 is in use.

It will also be noticed that the "B" battery B_2 and the head-phones T are connected together at what may be termed the bottom of the plate circuit of a tube. The "B" battery B_2 has its negative terminal connected to the positive terminal of an "A" battery. By doing this we get the additional voltage of the battery B_1 communicated to the plate A_1 of the tube, whereas if we had connected the negative terminal of the "B" battery to the negative terminal of the filament battery we would have lost this extra voltage. Some definite convention is highly desirable, and the practice of connecting the negative terminal of the "B" battery to the positive terminal of the filament battery is one always to be recommended, except perhaps in very special cases which need not be discussed here.

POSITION OF "B" BATTERY

The question of whether the "B" battery should be in the position shown, or should change places with the head-phones T is a doubtful point in a single-tube circuit. When two or more tubes are used, the "B" battery should be connected next to the filament battery, but when a single tube is used there are

Cannon-Ball
HEADSET $3.50

Regardless what price you pay for a receiving set, its efficiency and sensitiveness means nothing if your headset or loud speaker fails to do its duty.

The Camco Cannon-Ball Headset is rapidly increasing its circle of enthusiastic friends. It is a quality headset at a fair price. And you can count on it to give you a reproduction of the program with a clearness and richness of tone that will please your ears.

Ask your dealer to let you examine the interior of the phones. Slip them over your head and on your ears and note how comfortable they are.

Camco craftsmen specialize on radio headsets and loud speakers. This develops perfection to the highest degree.

Invest your money wisely—Camco Cannon-Ball, $3.50; Camco Grand, $4.75, and the

CAMCO
Loud Speaker
$9.50

The brown fibre, Camco Loud Speaker pictured here is a very pleasant family friend. Twenty-two inches tall. Ten inch bell. Artistic, black enamel metal base and six foot, durable black cord. Complete with a clear, mellow tone Camco Loud Speaker Unit making a quality speaker at a fair price. At your dealers.

DEALERS: Ask your jobber about Camco products or write for complete details.

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The Nutron Solodyne Tube was developed by our engineers especially for the first tests of the Solodyne principle made by Radio News and fully described in last month's issue.

NUTRON
SOLODYNE
REG. U.S. PAT. OFFICE
TUBES

Mr. Gernsback says: "We are confident that during the next few years the Solodyne principle will be adopted in the majority of receiving sets." By all means get acquainted with the Nutron Solodyne Tubes which give the Solodyne Circuit untold possibilities! Complete diagrams and instructions are included with each Tube . . . . . **Price $6.00**

GUARANTEE. *Each Nutron Solodyne Tube is guaranteed in every way and will be replaced at once if, within 10 days, it should not work and the filament still lights.*

Nutron Parts for Solodyne Circuits

For best results from the Solodyne Circuits you must use only the best of materials. There is not much energy to lose. Low-loss condensers and coils will give results. The following parts have been especially designed by our engineers for use in Solodyne Circuits and consequently will give superior results in standard circuits by reason of their unusually fine construction.

Nutron Condenser (Vernier Type). A low-loss condenser, 23-plate, volume on distance stations controlled by Vernier. **Price $3.50**

Nutron Transformer (1-10 ratio). Has exceptionally high number of turns on secondary . . . . . **Price $3.00**

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Nutron Grid Leak. This grid leak is highly critical as to adjustment because the regeneration is controlled by it. It is very positive in its action and is especially designed for Solodyne Circuit . . . . . **Price $1.25**

Nutron Tuned Radio Frequency Kit

At last you can build at a very moderate cost "that big set" you have wanted. Build a 5-tube Neutrodyne Receiver or other tuned radio or tuned regenerative receiver. Send for this laboratory-tested kit and be sure of distance and selectivity.

We make the assertion that there is not a better set of transformers, low-loss condensers or Nutrons (for neutralizing) on the market than this Kit contains. If you want the best results you must always use the best materials and workmanship. The Nutron Tuned Radio Frequency Kit furnishes the very best available material and workmanship at the lowest possible price.

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Parts and diagrams for Solodyne circuits consisting of one stage radio frequency and two stages of audio frequency amplification are being manufactured and will be on the market in August.

This is something that has been sought for years and is now completely developed. Our engineers have spared neither effort nor expense in perfecting these hook-ups and you will be simply amazed at the results they have secured. Watch for further announcement at an early date and don't miss the enjoyment in store for you!

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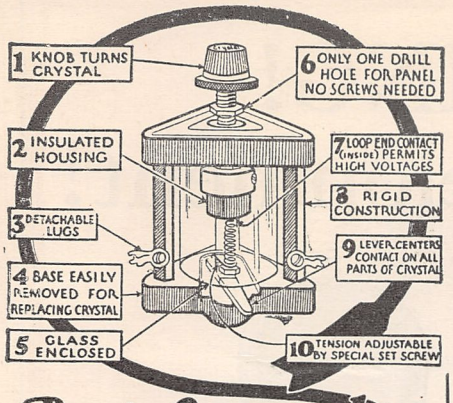

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arguments which may be advanced in favor of the idea of having the head-phones next to the "A" battery. The most cogent argument is that when the "B" battery is next to the filament battery, as shown in Fig. 10, if there is any leakage between the head-phones T and the operator wearing the head-phones, a shock may be received. This is not likely to happen in the case of Fig. 10 because the "A" battery B_1 is ordinarily insulated unless definitely earth connected. If, however, an actual connection were taken from the negative terminal B_1 to the earth, as shown by the dotted line in Fig. 10, the argument might apply. In any case, the author does not consider that this is an important point, because head-phones are generally well insulated and the chance of shock, or injury to the head-phones, is very small.

SPECIAL EARTH CONNECTION

It may be pointed out here that a connection between the negative of the "A" battery and the earth, as shown by a dotted line in Fig. 10, is generally desirable in the case of a loose-coupled circuit of this kind and helps towards stability.

It might be asked, "Why should not the head-phones T be connected next to the plate of the tube?" Here we have an example of the principle that no piece of apparatus which is likely to have a capacity to earth or a leakage to earth should be connected near a point at radio-frequency potential to earth. This question of capacity to earth is a very important one, and it might be as well to explain the meaning of the term. Anything which is connected by a short wire to the earth plate is considered as being at earth potential. If a large condenser is connected in between the earth and the object, the latter, to all intents and purposes, may be said to be at earth potential. Even a medium-sized condenser inserted in the lead between the earth and the object will not alter the fact that the object is substantially at earth potential when radio-frequency currents are flowing through the leads to the earth. When, however, audio-frequency currents are involved, a medium-sized condenser would not have the equivalent effect of an ordinary wire connection. If the condenser in the lead is of relatively small capacity, say, .0005 mfd., radio-frequency currents flowing through this condenser will set up potentials across it and the object previously mentioned will certainly not be at earth potential.

EFFECT OF THE BODY

Now there are many objects of substantial size in a radio receiving station, and the principal object is the operator himself. He is, to a certain extent, a conductor, and since he stands on the floor he acts like one plate of a condenser, the earth acting as the other plate. The human body, therefore, has a capacity to earth. If, then, we were to touch the aerial terminal of the receiver, it would be equivalent to connecting a large condenser across aerial and earth. Incidentally, it would also be more or less equivalent to connecting a leak across aerial and earth, because the operator is not usually perfectly insulated from the ground. The "capacity to earth" effect of the human body is particularly noticeable when the hand is placed near a condenser or other part of a sensitively adjusted receiver working on short wave-lengths. The higher the frequency of the currents in a radio receiver, the more susceptible will they be to interference by the capacity effect of the human body. In the case of

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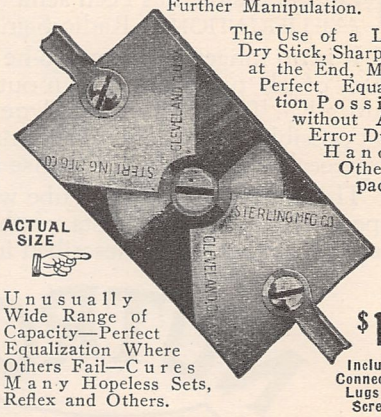

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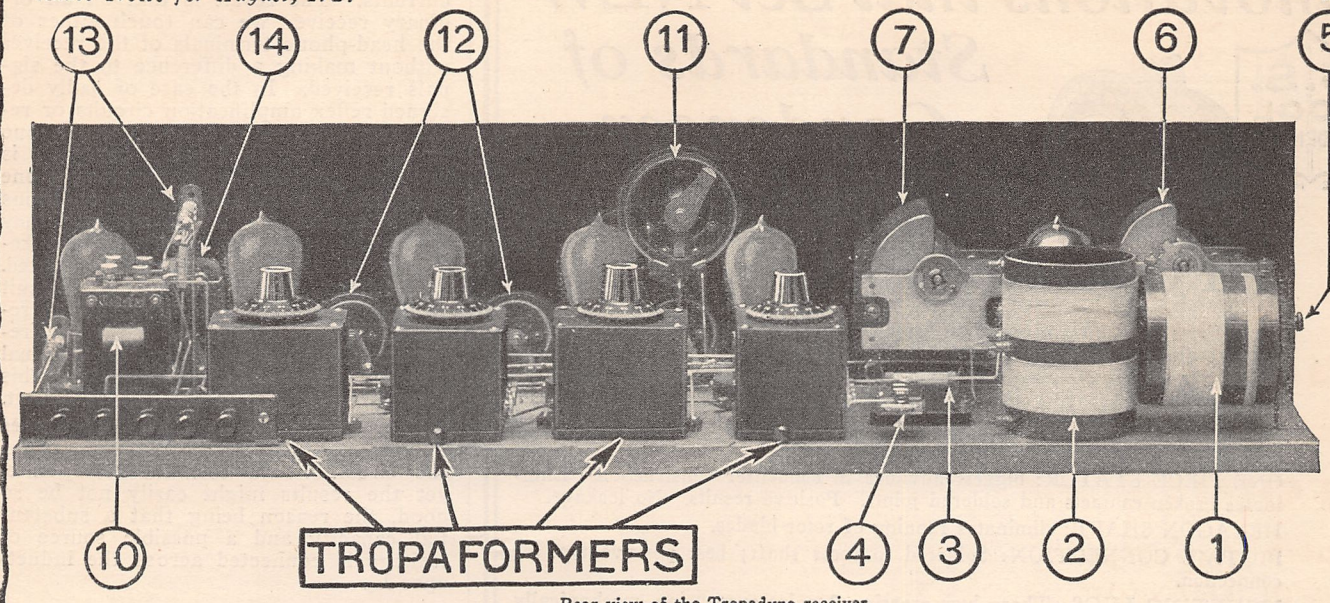

Rear view of the Tropadyne receiver.

The spacing of the R. F. transformer coils can be clearly seen. The numbers designate the following instruments: 1, the tuner; 2, the oscillator coil; 3, the grid leak; 4 and 5, fixed .0005 condensers; 6, the tuning condenser; 7, oscillator condenser; 8, loop jack; 9, tuned R. F. transformers; 10, A. F. transformer; 11, potentiometer; 12, rheostats; 13, jacks for detector and loud speaker.

the Tropadyne circuit one tube acts both as oscillator and detector, and is a frequency changer. This is where this circuit gets its name; *tropaia* from the Greek, meaning change, and *dyne* meaning force.

Fig. 1 shows the Tropadyne circuit. Only one tube is shown, which is merely a frequency changer when used in a Super-Heterodyne receiver, and may be used with any type of Super-Heterodyne now ... As shown in the diagr... both loop ...

The electrical center of the oscillator circuit is approximately at the center turn of the coil. In practice, this connection is not critical. It may be two or three turns either side of the center, without seriously dec... ing the efficiency.

Although ... flowi...

be tuned independently to the same or different wave-lengths. This is a condition ... has never before been attained ... tube ...

THE TROPADYNE

Improved Super-Heterodyne, Radio's Latest Achievement

(Reprinted from August Radio News)

In the August, 1924, issue the Editor of RADIO NEWS has this to say about the TROPADYNE circuit:

> "Here is a remarkable Super-Heterodyne receiver which we warmly recommend to our readers. It has several new and unusual features. In the first place only six tubes are used giving as much volume as the average 8 tube Super-Heterodyne. The selectivity of this set is unusual. Unequalities of the intermediate transformers have now been done away with by tuning each transformer. After the transformer has been tuned it can be left this way, no further tuning being necessary. This system makes for maximum sharpness and maximum volume. Another outstanding point of superiority of the Tropadyne circuit is that it practically does not radiate, thereby not interfering with other nearby receiving stations. Most Super-Heterodyne circuits, as is well known, are powerful radiators."

For the first time it is now possible to build a real Super-Heterodyne that not only exceeds them all, but is the only Super-Heterodyne that is scientifically balanced. Heretofore when building a Super-Heterodyne you either made or bought the intermediate transformers. These *never* matched as it is impossible to make two windings exactly electrically alike.

While some firms are advertising matched or balanced transformers this is a misleading statement because even though they are balanced ever so well, when placing them in the circuit they become unbalanced automatically due to inductive effects between transformers, lead wires, etc.

The TROPAFORMERS built according to the inventor's—Mr. C. Fitch—specifications can be scientifically balanced by any-one. Each transformer is equipped with one of our well known condensers which is shunted across the secondary of the transformer. This is the big secret of the TROPADYNE circuit and accounts for its wonderful work. Once the TROPAFORMERS are tuned by means of the shunt condensers they need not be touched again; *the balancing is permanent.*

Any other technical information will be gladly supplied by us. We offer to the trade and those interested in building their own TROPADYNE Super-Heterodyne the following:

No. 350 Kit containing four TROPAFORMERS with shunt condensers, tuner, shown under (1) in the above illustration, and one oscillator coil, shown under (2). Price complete with booklet giving full directions **$28.75**

No. 351 Tropaformer, each **6.75**

No. 352 Tropadyne Bakelite Tuner, each **1.25**

No. 353 Tropadyne Bakelite Oscillator coil, each **1.50**

Use Coupon if Your Dealer Cannot Furnish.

No. 351 **$6.75**

(Patents Pending)

The TROPAFORMER here illustrated is the only scientific balanced intermediate Super-Heterodyne transformer. It combines transformer and condenser, and enables the transformer to be tuned to the very finest degree. Once tuned it need not be touched again. Built entirely of hard rubber.

This TROPAFORMER does away with exchanging tubes in order to balance the circuit. Each TROPAFORMER is tuned to its tube and vice-versa.

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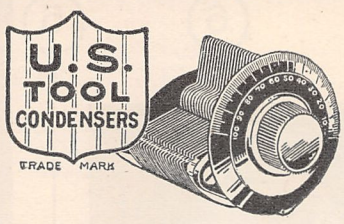

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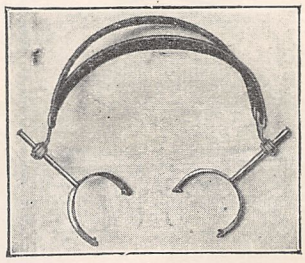

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audio-frequency currents, the capacity of the human body is not sufficiently great to interfere quite as much with these currents. The result is that on an ordinary receiver we can touch either of the head-phone terminals of the receiver without making a difference to the signals received. In the case of badly designed reflex amplification circuits or reflex amplification circuits in which one or other of the head-phone terminals is in such a position that by touching it one is altering the radio-frequency conditions in the circuit, the signal strength may be greatly varied and perhaps audio-frequency oscillations or buzzing produced. If, however, the audio-frequency circuit is quite separate and unconnected as regards mutual effects, to the radio-frequency circuit, touching either terminal will not make much difference. This should be the case in the Fig. 10 circuit.

If, however, we had the head-phones T connected next to the plate of a tube, the circuit would continue to operate, yet the results might easily not be so good, the reason being that a substantial capacity and a possible source of leakage is connected across the inductance L_3.

CAPACITIES TO EARTH

Any large body, such as an "A" battery or "B" battery, or even head-phones, has a capacity to earth. This capacity is the condenser effect between the battery, say, and the earth lead and between the battery and the walls of a room and the floor, etc. Small objects, such as connecting wires, grid condensers and similar objects, have no appreciable capacity to earth, and any undesirable effect which might arise with a larger object is absent when the object is small. In the case of the "B" battery and "A" battery, these have a substantial capacity to earth, and the head-phones also, especially when worn on the head, have a capacity to earth. A little thought will show that the effect of connecting the head-phones T next to the plate in Fig. 10 would be equivalent to a condenser being connected across L_3. Quite apart from the capacity of the different components to earth, they have a very important self-capacity effect towards each other, so that even if there were no capacity to earth it would still be undesirable to connect the head-phones T next to the plate. For example, when standing near the receiver, the human body and "B" and "A" batteries would form a condenser, and since the head-phones are being worn on the head, there is a condenser effect between the head-phones and the human body. Here again we would have a capacity effect across the inductance L_3. Even if the head-phones were lying on the table, they and their leads would form a condenser with the batteries. Not only is there a capacity effect in these cases, but there is usually a certain amount of leakage. This may easily happen when head-phones are being used, but it is far less likely when a loud speaker is being employed. For this reason, and for the reason that a loud speaker has no very large capacity to earth when kept away from the batteries, it is far less injurious to have a loud speaker connected next to the plate of the tube in the circuit of the Fig. 10 type than head-phones. This point is to be borne in mind as, indeed, are all the points dealt with here, because it is sometimes necessary to connect the head-phones or loud speaker in a position which is not the most satisfactory from the point of view of general principles. Special cases may necessitate the inclusion of head-phones or loud speaker next

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(PATENTS PENDING)

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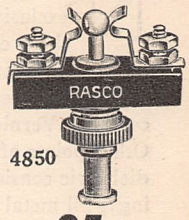
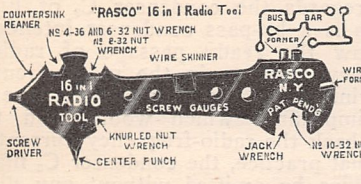


25c

16 in 1 Radio Tool 35c

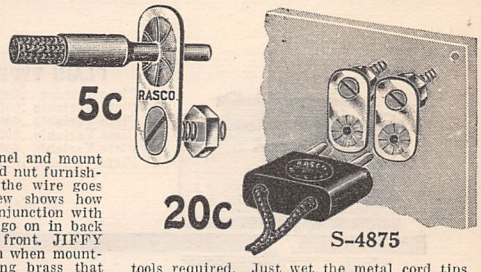


Here it is! The radio tool that will bring happiness to all radio experimenters and constructors. Here is a tool that does 16 different things and does them well. A tool that does practically everything required in building your radio set. The tool is built of hardened steel, exactly as per illustration, highly finished. Here are some of the uses: 1. Screwdriver. 2. Center punch. 3. Countersink. 4. Bus bar wire bender. 5. Bus bar and wire bender for 8/32 screw. 6. Bus bar and wire bender for 6/32 screw. 7. Socket wrench for jacks. 8. Socket wrench for 4/36 nuts. 9. Socket wrench for 6/32 nuts. 10. Socket wrench for 8/32 nuts. 11. Wrench for knurled nuts. 12. Screw gauge for 4/36 screw. 13. Screw gauge for 6/32 screw. 14. Screw gauge for 8/32 screw. 15. Screw gauge for 10/32 screw. 16. Knife for wire skinning.

These are only the important uses of the tool, but many other uses will readily suggest themselves to every radio experimenter. You will wonder how you have gotten along before without the **16 in 1 radio tool.** Get one of these happiness tools. You will never again be without it. Size 4⅝ x 1½ in.

No. S-4800 RASCO 16 in 1 Radio Tool, each.....**$0.35**

"RASCO" "Jiffy" Jacks and "Jiffy" Plugs



Again, Rasco leads with a small but important radio novelty. JIFFY JACKS are the simplest, and most efficient Cord Tip Jacks ever designed. Stamped from a single piece of metal they grip any style cord tip from any make phone or loud speaker. The JIFFY JACKS take but a minimum of room. All you need do is to drill two small holes in your panel and mount the JIFFY JACK with screw and nut furnished. **No soldering necessary** as the wire goes right on the screw. X-ray view shows how two of the jacks are used in conjunction with our **Jiffy cord plug.** The jacks go on in back of panel, only screws show in front. JIFFY JACKS take practically no room when mounted and are made of best spring brass that will not wear out. Hundreds of other uses for our JIFFY JACKS. **We will pay $1.00 for every new use for JIFFY JACKS that is accepted by us.**

JIFFY PLUGS are made of semi-hard rubber into which the tips of your phones or loud speaker are pushed. The cheapest and simplest plug ever designed. Its small size and neatness made it famous over-night. Size 1 in. long, ½ in. wide and ⅜ in. thick. No tools required. Just wet the metal cord tips and push through openings. Plug can be used with any standard cord tip jack, but best with RASCO JIFFY JACK.

S-4875-Two **Jiffy Jacks** with nuts and screws and one **Jiffy Cord Plug**.....**$0.20**

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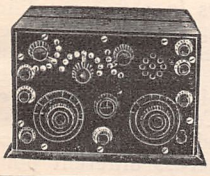
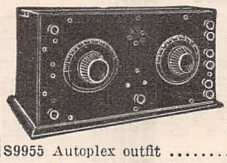


Exactly as shown with mahogany cabinet, panel, all necessary instruments, binding posts and pattern for assembling. This set can be put together by anyone in a few hours.

S9988 Reinartz Receiver **$13.50**

Autoplex Circuit



Will bring broadcast on loud speaker on single tube. Complete as pictured here. All parts, including mahogany cabinet, panel, instruments, binding posts, etc. Can be put together in a few hours time.

S9955 Autoplex outfit **$15.00**

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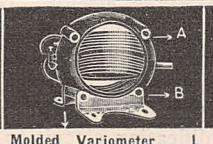

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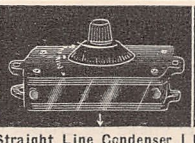

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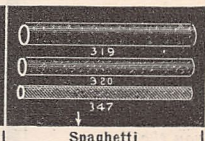

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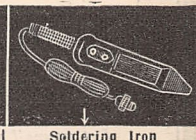

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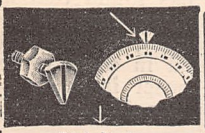

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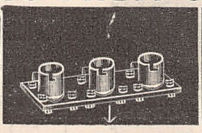

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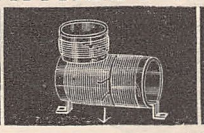

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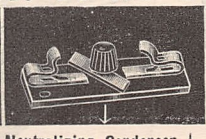

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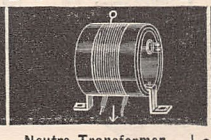

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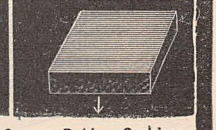

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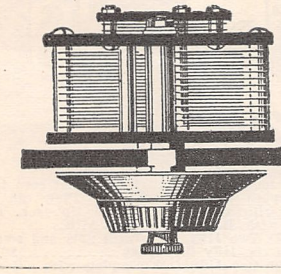

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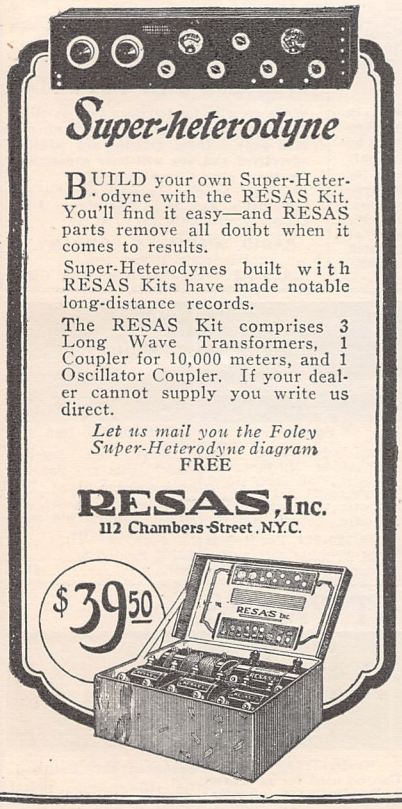

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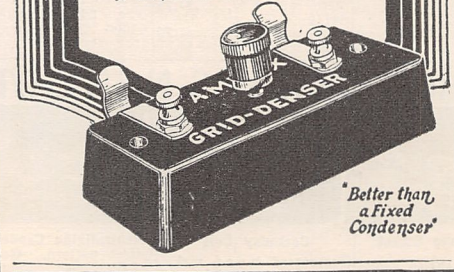

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to the plate of a tube and in between the plate and an inductance carrying radio-frequency currents. The dangers which are likely to arise by doing this should be noted.

AN ADDITIONAL POINT

An additional point which should be borne in mind is that when head-phones are used, the capacity they have in respect to earth and other pieces of apparatus is continually varying owing to different adjustments of the head-phones on the head and to the fact that the operator is not absolutely stationary and to the fact that his hands are being used to make various alterations in tuning, etc. While a capacity effect of this nature is bad, a varying capacity effect is very much worse, particularly when receiving on short wave-lengths and when the apparatus is adjusted in a very sensitive manner to a weak signal, *e.g.*, when using re-action. When a loud speaker is being used we can say that there is no leakage, but only a capacity effect, and although this capacity effect is not desirable, yet it is not very harmful in many cases because the loud speaker is stationary and the capacity effects remain constant.

As regards the condenser C_3 of Fig. 10 this is a by-pass condenser intended to allow the ready passage of radio-frequency currents in the plate circuit. The windings of the head-phones have a high impedance which would tend to choke back the radio-frequency currents. In actual practice, the condenser C_3 may sometimes be omitted without any disadvantage. In this case the radio-frequency currents pass through the condenser formed by the parallel leads to the head-phones and the distributed capacity of the windings.

The condenser C_3 is, like other condensers, used in reflex amplification circuits, sometimes desirable while sometimes it is best omitted. It is in most circuits a matter for individual experiment, and its value is also a matter for trial. There are really three capacities for fixed condensers in reflex amplification circuits, although the ordinary self-capacity of the head-phones or transformer windings is sometimes sufficient without being supplemented by any extra condenser. Condensers of .0003 mfd., .001 mfd. and .002 mfd. capacity are useful to try across different points in a reflex circuit. It is owing to the fact that different head-phones and different transformers have different distributed capacities and different impedances, and these two properties have a very important bearing on the tendency of the reflex amplification circuit to oscillate at audio-frequency.

THE CONDENSER C4

The condenser C_4 in Fig. 10 may, in practically all cases, be omitted, because the primary T_1 of the step-up transformer T_1 T_2 usually has sufficient distributed capacity. Here, again, it is a matter for experiment, but the author has found that as a general rule the condenser may, in the case of most transformers, be omitted. It will usually be found in most reflex circuits that if a condenser is really of any use, its capacity should be about .002 mfd.

The condenser C_5 is of greater importance, and here it may be stated as a rule that some additional capacity will be required. A fixed condenser C_5 is employed to shunt the secondary T_2, and the value of this capacity may be .0003 mfd., .001 mfd. or .002 mfd., according to the type of transformer used and the actual type of circuit employed. In the case of the Fig. 10 circuit, the condenser

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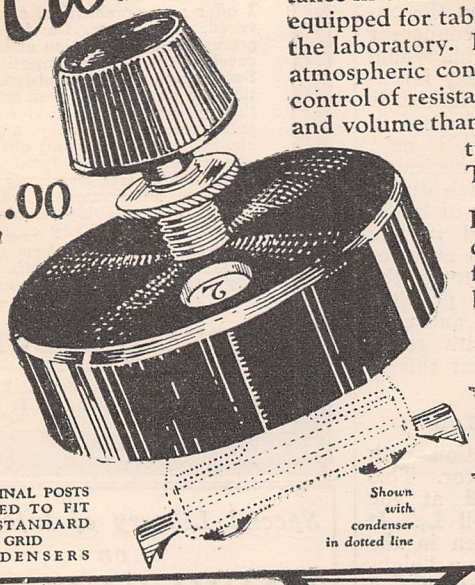

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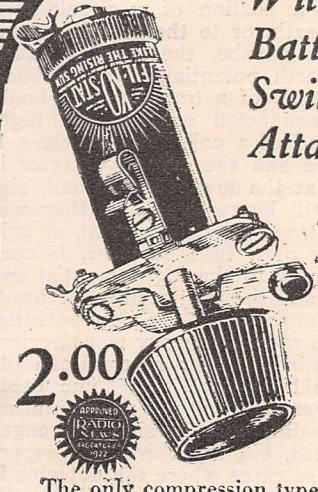

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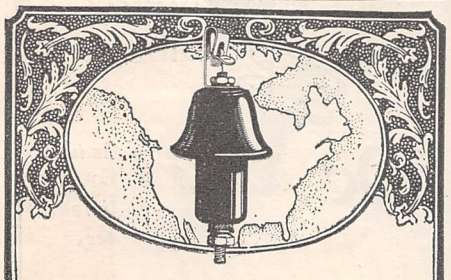

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C_5 may have a capacity of .001 mfd. and this will probably always be satisfactory. It is to be noted that if too large a condenser is employed here, it will, without affecting the radio-frequency circuit, act as a partial short-circuit for the audio-frequency currents supplied by T_2. A very small condenser in place of C_5 would have no material effect on the potentials supplied by T_2, but a condenser of very large capacity, say, 1 mfd., would render the arrangement extremely insensitive. The author has found that it is quite possible to detect the difference in signal strength between the .001 mfd. condenser and the .002 mfd. condenser, but there is really not very much difference. In any case, a condenser of larger capacity than .002 mfd. should not be employed. The value, or even need, of these fixed condensers constitutes the great unknown factor in the problem of effective reflex amplification, and anyone who is experimenting with reflex amplification circuits should bear this in mind.

POSITION OF THE CRYSTAL

Another point is in connection with the position of the crystal detector. This detector should be connected at the radio-frequency end of the coil L_4. It will usually be found that even in the case of a transformer there is a "high-potential" end and a "low-potential" end, the latter being connected or tightly coupled to a portion of a circuit connected to earth, or to the batteries associated with a tube, these being taken to be at earth potential. Head-phones, or the primary of a transformer, should never be connected next to the high-potential end of a coil. Nevertheless, if this is done and the crystal detector is connected at the low-potential end, signals will still be received, but they will not be as strong as if the crystal, or grid in the case of a tube detector, is connected directly to the high-potential end of the coil and the transformer, or head-phones, connected to the low-potential end. When radio-frequency transformers are used, as in Fig. 10, a reversal of leads to L_4 should be tried. In some cases the above remarks will not apply, and no appreciable difference in signal strength will be noted, but in others, and especially in those cases where the detector is connected across a single coil in the plate circuit (the high potential end of the coil in that case being the one nearest the plate). It is most important to connect one side of the detector directly to the high-potential end of the inductance.

(*To be continued*)

New Zealand to Argentina

(*Continued from page* 311)

Tube—One 50-watt Power Type.
Grid Leak—5,000 ohms.
Generator—1,000-volt 300 watts.
Motor—½ h.p.
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Modulation for phone is obtained by plugging in a microphone between nodal point and earth. Using this type of modulation, speech is loudest when radiating 2.5 amperes on 160 meters and I have worked over 600 miles, being received on detector only.

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Aerial—Of inverted L type. Two 5-inch cages each of four wires (3/18 copper) 50 feet long, with a 25-foot lead-in. It is 64 feet high at one end and drops at an angle of 45 degrees to about 21 feet. The spreader at the top is 10 feet 3 inches long and one at the lower end is 5 feet. Lead-in insulator was made with six large bobbin insulators on ⅜-inch brass rod, with bitumen between each to make it waterproof. Leads to both aerial and counterpoise are made with ¼-inch copper band.

The aerial insulators are ⅜ inch thick, plate glass strips 14 x 1¾ inches and as holes could not be bored in these, hollows were chipped in sides and bridles attached.

The counterpoise is 7 feet from the ground and consists of 17 wires, each 40 feet long; also, there is a skeleton counterpoise underneath this and joined in parallel. The receiver is the usual three-circuit regenerative type using low loss coils made from heavy cotton covered wire. I also have a two-stage transformer coupled, radio frequency amplifier, which is only used for very weak signals, or distant broadcast stations. The main mast is 65 feet high and is made of two-unit piping supported on top of a wooden mast, while the small one is of wooden construction 21 feet high.

On 175 meters my radiation used to go to 4.3 amperes; but on 125 meters it is only 2.3 to 2.9 amperes. Just recently we conducted tests in New Zealand on low waves and although the radiation was much lower, we found our signals increased in strength considerably. If you fellows in the United States keep a sharp lookout for me at 7 GMT nearly every night in the week, it will not be long before we can have a round-the-world relay! I'll do my part at this end, so now it's up to you!

IVAN H. O'MEARA.

Book Review

THE EVENING WORLD RADIO DICTIONARY. By James S. Caulfield, E.E. 3¾ x 5¾ inches, 21 pages, paper cover. Published by the Press Publishing Company, New York City. Price, 25 cents.

This little Radio Dictionary which so well fits the pocket will prove indespensible to the radio fan who is not well acquainted with the various terms employed in the radio field today. Not only will one gather the exact meaning of a particular radio term or phrase, but will learn something of that portion of radio to which it is related. In other words, aside from giving the definition of the word, Mr. Caulfield presents a detailed explanation of the whys and wherefores, as well as information regarding what to do and what not to do. There are no important terms left out. The dictionary is quite complete.

PITMAN'S RADIO YEAR BOOK (1924). Compiled by 24 well known English radio and electrical authorities. 156 pages, paper cover, fully illustrated. Published by Sir Isaac Pitman & Sons, Ltd., Parker St., Kingsway, London W. C. 2. Price 1 shilling, 6 pence.

Pitman's Radio Year Book covers an exclusive portion of the radio field and is valuable if for this reason only, as there are but few books or pamphlets published nowadays which contain information aside from the explanation and construction of radio transmitting and receiving sets. Do not for the moment imagine that this book is devoid of such material. On the contrary, there are some excellent chapters in the "Technical Section" on vacuum tubes, crystal detectors, aerials and their design, condensers, amateur transmitting sets, etc. It is the "General" and "Commercial" sections that contain material usually unavailable to the experimenter. This new edition includes a complete list of the calls of commercial, broadcast and amateur experimental radio stations

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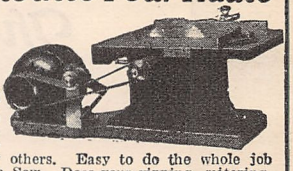

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in Great Britain, a list of wireless societies, condensed biographies of eminent persons in the radio field, information on how to obtain a license and much other material.

The symposium of suggestions received from well known wireless experts on the subject of radio inventions is a feature which we venture to think may be read with interest, and possibly with profit, by the amateur, the expert and the manufacturer.

THE HOME CONSTRUCTOR'S WIRELESS GUIDE. By W. James. 5 x 7½ inches, stiff cloth cover, 199 pages, fully illustrated. Published by The Wireless Press, Ltd., 12-13 Henrietta St., London. W. C. 2. Price, 3 shillings, 6 pence.

In this book we have a condensed but complete course in wireless, aside from the chapters given over to the construction of crystal and vacuum tube receiving sets. The author begins with a chapter on aerials and grounds—the logical beginning—followed by an excellent dessertation on tuners and couplers which includes tables and formulae for the determination and calculation of inductance values. The third chapter takes up condensers and coils, but in this instance deals with the relation of capacity and inductance. The construction of crystal receivers in chapter four leaves nothing to the reader's imagination.

The next two chapters are occupied by text on the two and three element vacuum tube and its application to radio as detector and amplifier. Chapter eight deals with the construction of numerous forms of radio receivers and is fully illustrated with circuit diagrams, working drawings and photographs of the completed units. Chapter nine describes a number of excellent forms of sensitive single tube receiving circuits that are today popular in both England and America. The final chapter covers dry cells and storage batteries and when and how they are used for the different kinds of vacuum tubes.

This is indeed a good book for the amateur experimenter and we do not hesitate to recommend it to our readers.

WIRELESS TELEPHONE—What It Is and How It Works. By Philip R. Coursey, B.Sc. 5 x 7½ inches, stiff cloth cover, 113 pages, fully illustrated. Published by The Wireless Press, Ltd., 12-13 Henrietta St., London, W.C. 2. Price, 2 shillings, 6 pence.

One is assured of authoritative information when it is from the pen of Philip R. Coursey. His work in the radio field is well known throughout England and America. This book sets out in a simple manner not only the essentials of the radio telephone, but how it operates, and how its parts are built up. Each instrument that goes to make up a radio telephone transmitting and receiving set is explained in detail. To give a clearer idea of the appearance and arrangements of the apparatus than can be conveyed by ordinary circuit diagrams, many sketches and photographic illustrations are given.

It is an excellent book for those who are genuinely interested in "what makes the wheels go 'round."

RADIO AND HIGH FREQUENCY CURRENTS. By Edgar T. Larner. 5 x 7½ inches, stiff cloth cover, 54 pages, fully illustrated. Published by Crosby Lockwood & Son, Stationers' Hall Court, Ludgate Hill, London, E.C. 4. Agents: D. Van Nostrand Company, 8 Warren St., New York City. Price, $1.50.

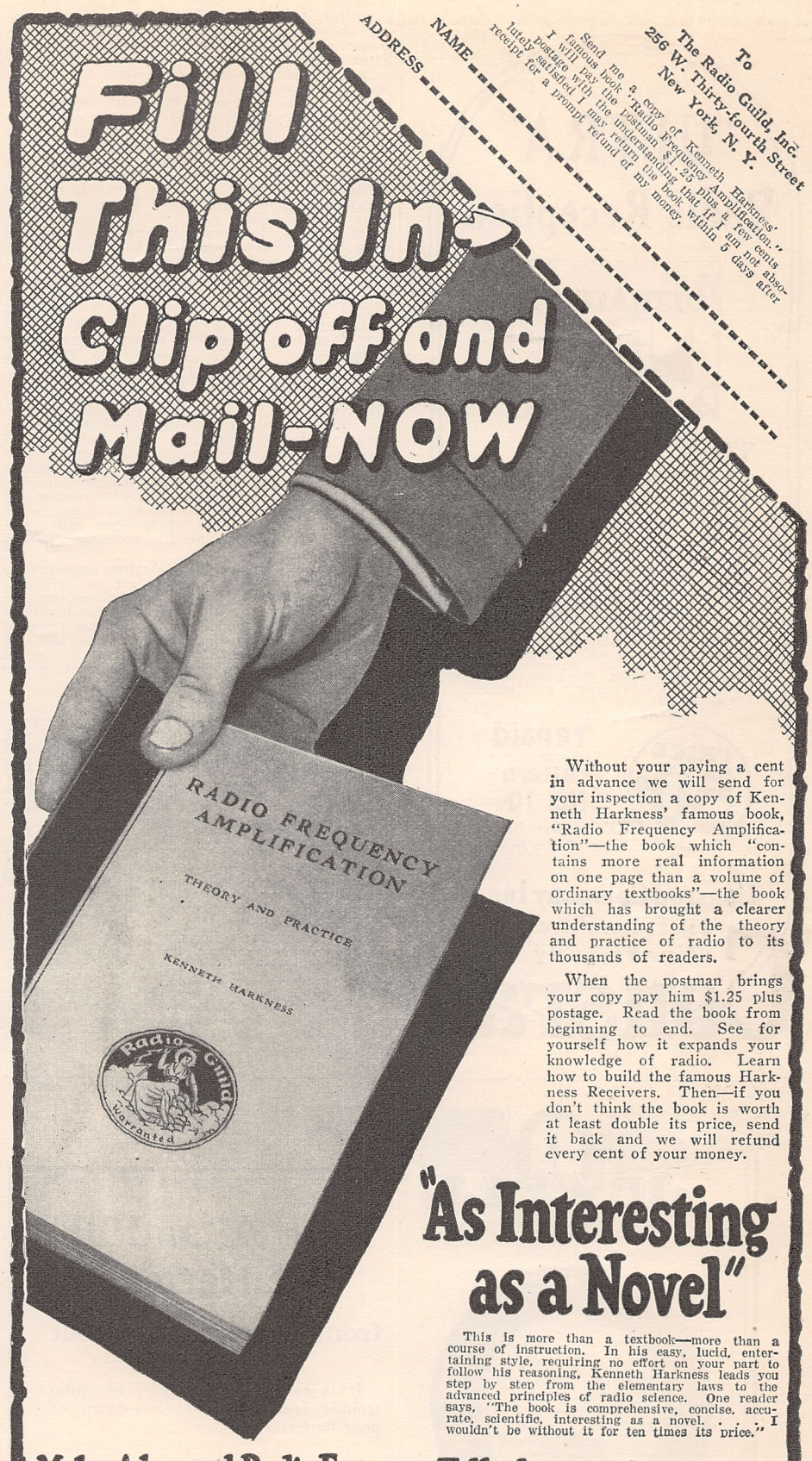
High frequency currents are the very basis of radio telegraphy and telephony and it is only by a study of this subject that one may expect to gain even a conception of the more advanced work in the radio field. Mr. Larner has devoted the entire book to high frequency currents as they are applied to radio, and has formed the whole into a most interesting and comprehensive study. We recommend this book to our more advanced readers.

DUNLAP'S RADIO MANUAL. By Orrin E. Dunlap, Jr., B.S. 5 x 7½ inches, stiff cloth cover, 267 pages, fully illustrated. Published by the Houghton, Mifflin Company, 2 Park St., Boston, Mass. Price $2.50.

In introducing this book to our readers, we wish to quote a portion of the preface by the author. He says: "This book is elementary—it tells what the great host of radio followers want to know about their receiving sets and the invisible waves which carry entertainment to them.

"You will find radio explained here as I wished for someone to tell me about wireless in 1910, in non-technical terms. Radio in this book is stripped of technicalities and the story is told so that everybody can understand and enjoy it."

This was Mr. Dunlap's ambition, his dream: to turn out a story of radio that would teach the



Without your paying a cent in advance we will send for your inspection a copy of Kenneth Harkness' famous book, "Radio Frequency Amplification"—the book which "contains more real information on one page than a volume of ordinary textbooks"—the book which has brought a clearer understanding of the theory and practice of radio to its thousands of readers.

When the postman brings your copy pay him $1.25 plus postage. Read the book from beginning to end. See for yourself how it expands your knowledge of radio. Learn how to build the famous Harkness Receivers. Then—if you don't think the book is worth at least double its price, send it back and we will refund every cent of your money.

"As Interesting as a Novel"

This is more than a textbook—more than a course of instruction. In his easy, lucid, entertaining style, requiring no effort on your part to follow his reasoning, Kenneth Harkness leads you step by step from the elementary laws to the advanced principles of radio science. One reader says, "The book is comprehensive, concise, accurate, scientific, interesting as a novel. . . . I wouldn't be without it for ten times its price."

Makes Advanced Radio Easy

This book explains to you in easy-to-grasp language the theory of radio reception from A to Z. It tells you everything you want to know about radio—answers all your questions. Kenneth Harkness wrote this book in *your* language, the language *you* use every day—the language *you* understand. His book fills an open gap in radio literature. He explains advanced radio—hitherto understood by mathematicians only—yet he explains it in simple, easily-understood English.

Tells how to build Sets

Illustrated by 186 drawings, diagrams and photographs, this book explains in detail how to build five different types of radio frequency amplifying receivers. The second edition, just off the press, gives new and complete information on the popular "Harkness Reflex" which operates a loudspeaker with one tube. In a greatly enlarged and profusely illustrated chapter Mr. Harkness shows you how to build his new, improved one- and two-tube receivers, using this "knockout," record-breaking circuit.

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great lay public somewhat in the same manner that children are taught their ABC's; with interesting and absorbing tales accompanying each letter. Mr. Dunlap was, no doubt, inspired by such a thought, for he has managed to turn out just such a book. It tells the story of radio and teaches in the process. There is nothing dry about it, one page is quite as interesting as the next, and like a good story, you will not wish to lay the book down until you have read it from cover to cover. Do not look for complicated and puzzling illustrations, there are none. It is not the kind of book that must resort to quantities of drawings to make points clear. But what illustrations there are, are good, and the photographs blend in with the story. We need not tell you what each chapter covers. It is enough to say that the book is complete.

HOW TO BUILD AMATEUR VALVE STATIONS. By Philip R. Coursey. 5 x 7 inches, 74 pages, paper cover, fully illustrated. Published by The Wireless Press, Ltd., 12-13 Henrietta St., London, W.C. 2. Price, 1 shilling, 6 pence.

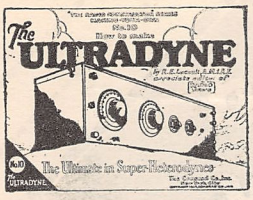
The object of this book is to guide the prospective radio amateur in the way of building his own vacuum tube receiving set. The description of various types of receiving sets is centered around the use of "units" or component parts which, when two or more are hooked together, form a complete receiver. Several different arrangements of receiving units are described in detail, since the use of this method of building radio sets enables a number of different receiving combinations to be obtained.

The various pieces of apparatus employed to make up a complete receiving set are fully explained so that the prospective builder, on the completion of his set, after following the directions given, will know something of the functioning of each instrument in the circuit. Comprehensive working drawings accompany the text and go to make the construction of any of the receiving sets a simple matter.

DER PRAKTISCHE RADIOAMATEUR. By Hanns Gunther (W. DeHaas) and Dr. Franzchs. Hard covers, size 5¼ x 8 inches, 316 pages, profusely illustated. Published by Franck'sche Verlagshandlung, Stuttgart, Germany.

This book is typically German, but in the agreeable sense of the word. It is devoted principally to amateurs and is made more interesting by a great many little illustrations scattered through the text, often of a comic cast and often very amusing. It has a clergyman preaching from his pulpit "But I say unto you," with the microphone hanging in front of him. There is quite a good picture of a Tyrolese dance to the radio. We have one unhappy man listening to the quotations from a falling stock market and a man stranded on the mountains hearing by radio that help is approaching. Reading the eleven Statutory requirements, which have to be given before the receiving set can be used in Germany makes us thankful that we live under a less paternal government.

"ULTRA"
Radio Reception



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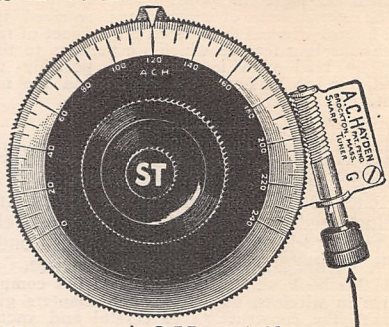

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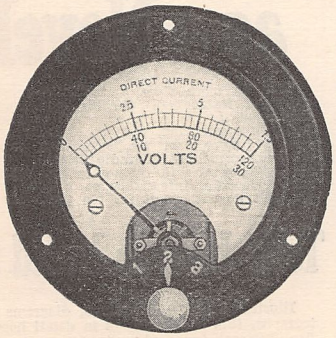

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An Inexpensive Efficient Reflex Receiver

(*Continued from page* 331)

The tube is a WD-11, rather soft I think, since it amplifies best at 45 volts. Perhaps this characteristic accounts for the fact that the tube sometimes detects, reducing the signal strength to about that of an ordinary regenerative receiver. I think a "C" battery would remedy this, however.

The ideal application of this hook-up would be to use three honeycomb coils in a standard mounting, as primary, secondary and plate impedance, respectively, with a double pole, double throw switch connected to the primary and secondary so as to enable the operator to use either a double or single circuit. However, I have never felt the need of more selectivity, so my present outfit is entirely satisfactory.

Altogether, this set is one in which most standard apparatus can be utilized, much can be home-made and any novice can tune. It lacks the R. F. transformer common to most reflex sets, a saving of from four to six dollars, and the low ratio A. F. transformer works better and usually costs less. As to operation, I have yet to find its superior among one-tube sets, reflex or otherwise, and its nearest equivalent would be a two-circuit regenerative with a stage of A. F. amplification. If anyone can show me a set as inexpensive as this, superior in range, volume, quality of tone, simplicity, selectivity, I'll change.

The Use of Iron In Transformers

(*Continued from page* 325)

as are used in radio, this source of loss can easily be tolerated; and the transformer with an iron core is more efficient, much more efficient, than one with only an air core.

At a frequency of 1,000,000 cycles a second, the slightest loss per cycle is multiplied to such an extent that it cannot be tolerated. Both things, Foucault currents and hysteresis, dissipate energy, and when even a small amount is dissipated one million times a second, it naturally mounts up. Hence high frequency transformers designed for such frequency should not have iron cores. An air core has no hysteresis nor Foucault currents; there is then no dissipation of energy, except the inevitable amount due to resistance in the wire; there is no supplementary loss. The effect of ordinary iron in a high frequency core would be to confuse everything hopelessly. The iron would not be properly magnetized; it would be screened by its Foucault currents. Nevertheless it would dissipate energy, and tend to wipe out or smear out the primary oscillations, destroying their features and making anything like clear speech impossible. There would not only be waste of energy, but there would be distortion. The resistance of the wire would be practically increased by the complicated reaction effects of the core.

It is rather surprising that these effects are not deleterious even in the case of audio-frequencies. It must have some bad effect, although it appears not to matter in practice. At the same time the cores of all transformers should be very carefully made, and these bad effects kept to a minimum, by special selection of the quality of iron and by thoroughly subdividing it in the lateral direction.

On these considerations is based the familiar fact that high frequency coils are made without iron, though in low frequency coils the use of iron is permitted and on the

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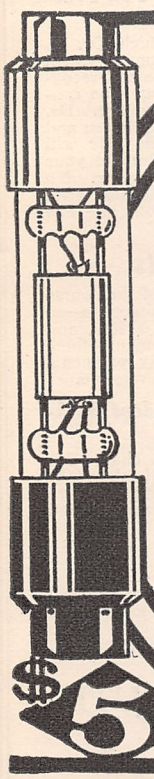

London
Hawaii -Porto Rico

A Canadian amateur (T. A. Crowe, Calgary), operating on three Myers Tubes, heard the concert broadcasted by 2 L.O., London, England, and picked up Hawaii and Porto Rico the same evening. (Calgary Herald, April 1st). Are you getting results like this? You can with

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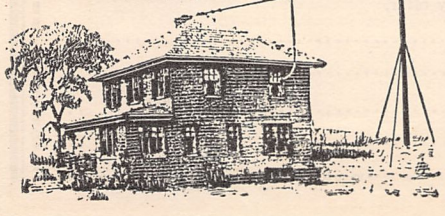

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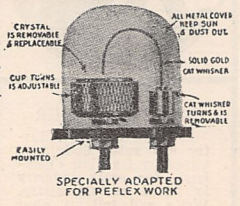

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whole found advantageous, though it should always be used with circumspection. It seems to me possible that sets and the articulation of loud speakers might be improved by dispensing with it, for instance, by using moving coils in a steady magnetic field. Permanently magnetized iron does no harm at all. All the effects spoken of are characteristic of varying magnetism under the influence of fluctuating currents.

A Remarkable New Loud Speaker

(*Continued from page* 296)

the audio frequency currents being led to K1 and K2. As we know, when the current is passed through the conductor there is a force which acts upon the conductor if it is placed in a magnetic field in a direction vertical to both the direction of the magnetic lines force in such a way that the current also travels at right angles to the magnetic field. Influenced by this force the aluminum foil, A, will oscillate at the frequency of the audio frequency current passed through it. A is mounted into a frame equipped with specially shaped pole pieces (Fig. 2) and can be easily taken out of the electromagnet. The Siemens loud speaker is shown in Fig. 3.

Sensitiveness of this loud speaker is claimed to be greater than that of any other like instrument known. It reproduces faithfully oscillations up to 10,000 per second without distortion. A duet of violin and piano broadcast from Vox Haus, Berlin, and reproduced by this loud speaker before the members of the "Elektrotechnisches Verein," gave an impression of the violin and piano being in the room.

The Siemens loud speaker is especially adaptable to performances before a very large audience. Models are also available for general amateur purposes.

With some insignificant alterations this loud speaker can do the work of the microphone. For this purpose it is sufficient to construct its parts somewhat more delicately and to employ a permanent magnet instead of the electromagnet. In this case the loud speaker acts as a current generator without using an extra microphone battery. In general, however, an amplification of this current will be necessary before it is impressed upon a modulator. Experiments with this microphone (Fig. 4) were so satisfactory that all the large German broadcast stations are seriously considering the adoption of it.

Loop Transmission Experiments

(*Continued from page* 313)

about 100 miles distant. Yet on the same night I was able to communicate with Denver with no difficulty and repeated the same feat for several nights, which proved that the incident was no mere freak. Notice that Denver's general direction just about splits the directions covered by the two sections of the loop AOB. It was also possible to work up in Oklahoma, Kansas and Nebraska. These sections are covered by the space between the arrows 3 and 4. No exceptions to the directional effect of the loop were noted, as it seemed to be very well defined. These results gave the loop a general DX range of approximately 1,000 miles in a decidedly limited direction, with steady, strong signals at most times, according to all reports by radio and card.

An additional note is necessary in regard to the counterpoise. It was tuned in on

the OT in the usual fashion because it had the same effect as with the antenna; it raised the loop current. The counterpoise is designated by CE in the diagrams.

Fig. 4 was the second arrangement used, with its electrical equivalent shown in 4b. The loop was completed through a metal cistern, which had its grounded pipes to complete the circuit. Instead of the fixed mica condenser this time, I used porcelain insulators to tie the loop return to the top of the cistern. This gave a very low capacity, low loss, condenser at C and my results were better with this loop anyhow, with all whom I communicated with. With the arrangement of Fig. 4 an increase in signal strength was noted by those stations, although I lost something over a tenth ampere in antenna current with the change in the loop.

The reports, especially from Denver, asked if I had increased power. Work with Dallas, Ft. Worth and other nearby cities up to 400 miles was particularly constant and gratifying. It was difficult to raise many stations because of the directional effects

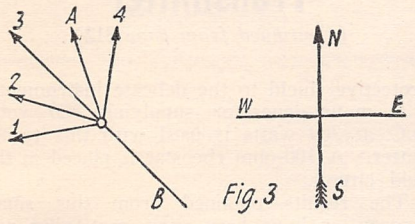

Fig. 3

A O B shows the loop. Marked directional effects were had between arrows 3 and 4.

which were so marked. If only I had been in Central U. S., I perhaps would have been able to work in the opposite direction, assuming normal bi-directional properties for the loop. As it was, the open Gulf of Mexico represented the other end of the workable directions and, as you know, it is notoriously free from Ham stations. So my activities were decidedly curtailed.

FINAL EXPERIMENT

The final experiment was the loop 4a with the addition of an insulator at I, separating the two portions of it by the equivalent to a small condenser which is indicated in 4b by the dotted C^1. The results with this final scheme were a surprise to me. The antenna assumed its original fundamental, nearly its original antenna current and lost the more marked of its directional properties. Denver still reported me very good, but I was able to work in several other directions, the northeast being the most noticeable. The range of the transmitter was not good or as consistent as with the antenna normal. That seemed true of all the loops. Although I received good reports, none of them were much more than 900 or 1,000 miles away, whereas the ordinary antenna arrangement generally could be depended on for 1,500 or more miles almost any night. Too much territory was left on the outside of the two arrows 3 and 4 to satisfy me.

Perhaps you see the reasons for my conclusions, now.

On receiving, the loop seemed to be no different than the conventional aerial; aside from having a different fundamental wave, and associated tuning properties. No noticeable directional effects were realized, although I was on the alert for such a manifestation. I had assumed that the directional effect would be more marked on the receiving than on the transmitting end, but such was not the case. Fading or other queer performance of the received signals was no different than normal to the best of my observance. It has additional theoretical advantages of lowered resistance and slightly

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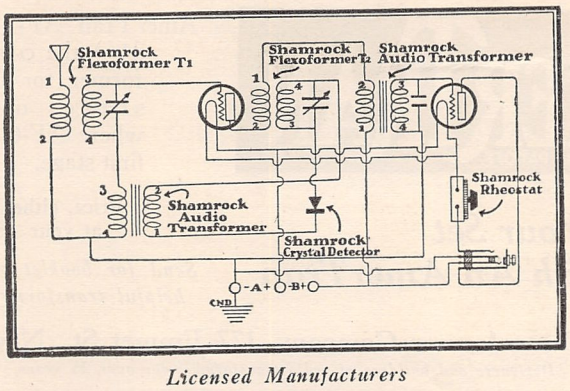

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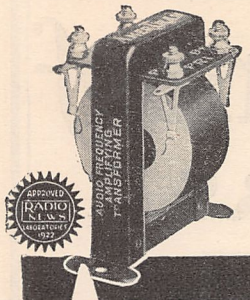

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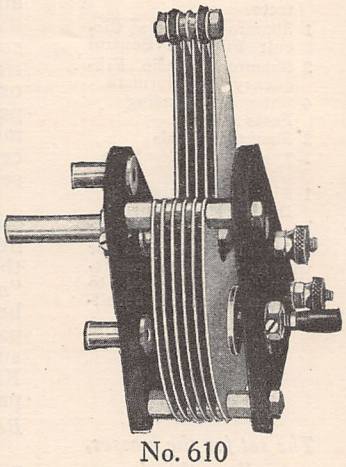

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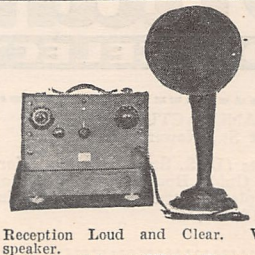

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greater area than the conventional detector.

A word of caution is both necessary and really useful if you should contemplate experiments in this line Make certain that every portion of such a loop is as rigid and unvarying as you can reasonably construct it. There is no doubt that the loop has a concentrated inductance value noticeably greater than that of the open antenna and, in my case, had also a greater capacity to ground because of the increased area. As a result, unless unvarying, the winds can shake the loop appreciably, varying the wave-length in a cheerfully flutelike, warbling way that is distracting to the fellow at the receiving end. This wave change effect is not at all apparent in receiving, because the ear is unable to detect small variations such as would be produced on a received signal by the receiving aerial varying and also because the secondary of the set generally determines the received wave predominantly.

An Ideal Amateur Transmitter

(*Continued from page* 312)

protective shield to the delicate instruments.

A motor-generator supplying 500 volts D.C. at 200 watts is used with this transmitter. A 100-ohm rheostat is placed in the field circuit.

The results obtained from this small transmitter have been very gratifying and demonstrate conclusively the fact that careful, conscientious design and workmanship are well worth while. The normal antenna radiation on 188 meters, using C.W., is 2.4 amperes, and with modulated methods, 1.8 amperes. The conservative night range is about 500 miles with C.W. and 75 with voice or buzzer. This has been exceeded on numerous occasions.

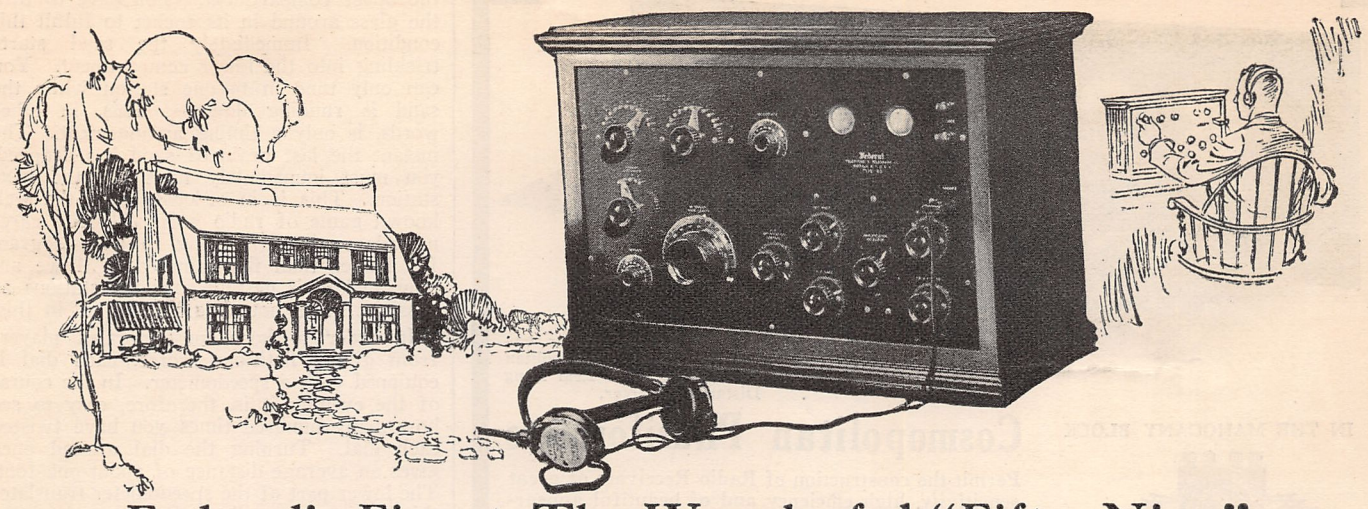
It is hoped that this information will be of value to those who have requested such data, as well as to others contemplating building or rebuilding a transmitting station.

The Cookoodyne

(*Continued from page* 305)

happen to hit the wave exactly, in consideration for this effort, a little door right above the dial opens up and a cute little cookoo bird hops out so you will know you have located your station. The cookoo simultaneously drops a ball into receptacle 14, which, having an underground passage, allows the ball to run into bowling alley 13. Next, turn dials 2 and 3 which work exactly in the same way. If you tune properly, the cookoos will pop out of the doors and drop balls into the respective receptacles. These balls all run down an incline after passing semaphore 16. If all the nine pins are knocked down by the three balls you score 10 points which are marked on the radio score-board. A word about the semaphores: These are desperately important. They work entirely automatically and have been provided by me so that should anyone when tuning in, do so with lightning rapidity, the three cookoos would drop the balls almost simultaneously. That would mean the three balls rolling down at practically the same time would collide with each other and cause fatalities among themselves. The semaphores prevent such a condition and let only one ball roll along the track at one time. The instant the track is cleared the next ball can roll down. This insures an accurate score.

To the left we see the hour glass (1). I should have stated before that the second you start tuning, the sand must all be in



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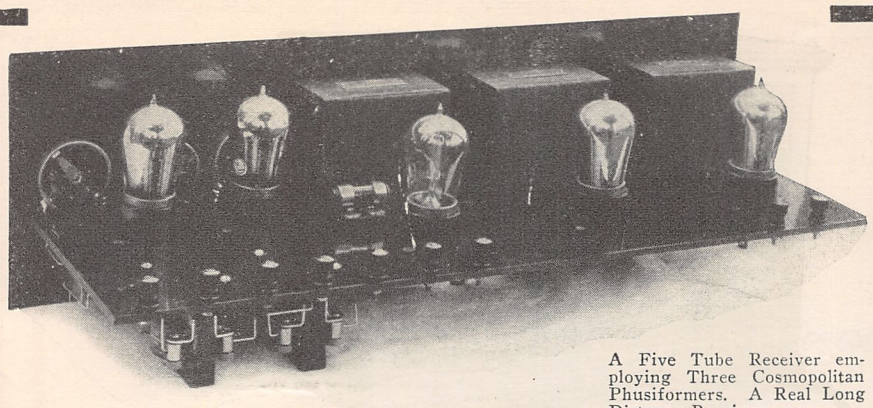

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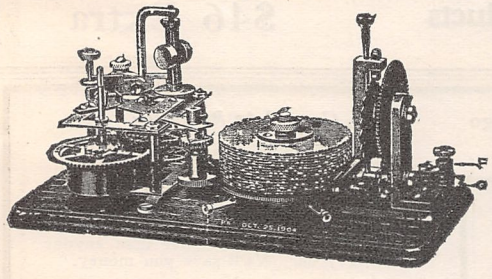

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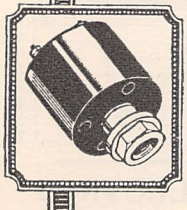

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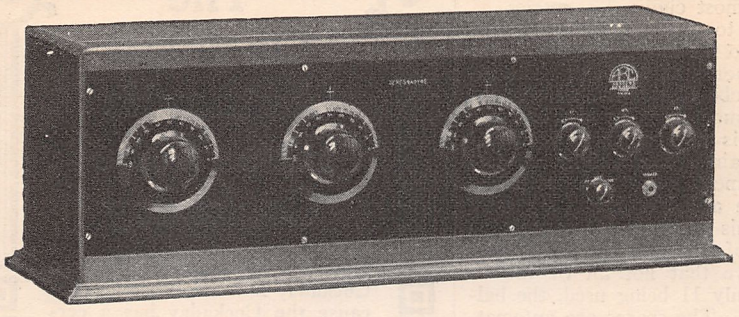
the upper compartment. You have to turn the glass around in its socket to fulfill this condition. Immediately the sand starts trickling into the lower compartment. You can only tune in to one station while the sand is running down. This, in other words, is only a timing arrangement. The instant the last grain of sand has dropped, you must immediately hunt for the next station. This is in order to play the well known game of radio golf. Nobody cares nowadays about listening to any program for longer than five minutes. All we are interested in is getting as many stations as possible. The hour glass helps us in this.

In order to keep loose-moraled players from giving fictitious scores, each dial is equipped with a speedometer. In the course of the evening it is, therefore, easy to see how many hundred times you have twisted each dial. Turning the dial around once gives an average distance of about one foot. The lower part of the speedometer translates this motion into miles. By the end of the year, therefore, you can see how many thousand miles you have run by twisting the dials, something which everyone is interested in, but so far has always been disputed. It is reduced to scientific accuracy now.

I have furthermore embodied many other important utilities in the radio set needed by every man. At the top you will see at No. 17 the weather indicator. When the little lady comes out, the weather will be fair. When the young man comes out, there will be rain. This information is important to all radio listeners. I might say in passing that the loud speaker (3) is just above this little house and gives a very decorative effect.

I have noticed in the past that thousands of people do not know what meters and wave-lengths are, so I have provided the outfit with a tape-measure (9). This tape-measure is there to measure the wave-length in meters. In the reverse side of the tape the equivalent is provided for in yards, thus when the user measures the incoming meters he will immediately know the equivalent in yards and inches, which is of tremendous help when stations are only a few meters apart.

To the right we have several important attachments. First, at No. 12, we see cigarette box compartment in form of a coffin. You press the button right near the edge of the box and out pops a cigarette into the arms of the undertaker (11). The action is entirely automatic, the same as death. You take the cigarette and light it by means of the electric cigar lighter (19). Right above this we have the calendar so that the user knows on what date he is receiving his program. Directly above that we have another interesting adjunct,—a clock (6). This is one of the greatest inventions of all times. This clock has been especially provided for the radio hound who plays all night long for great distance records. The papers are full of divorce cases where otherwise sane men are being divorced by their wives because they stayed up all night playing with radio. The Cookoodyne, gentlemen of the jury, I wish you to understand, will become the greatest American institution because it will do away with all divorce and other home-breaking tendencies that radio has introduced. The minute the clock strikes 12, a little catch incorporated with the clock is opened, which also opens a valve of tank (7). Through the outlet above the tank there issues immediately a cloud of sneezing powder, which with the compressed air is store in tank (7). The victim immediately starts sneezing his head off and it will become impossible for him to operate the outfit. He is automatically forced to cease operation and go to bed. The attachment is made in such a manner that it cannot be tampered with in any way by



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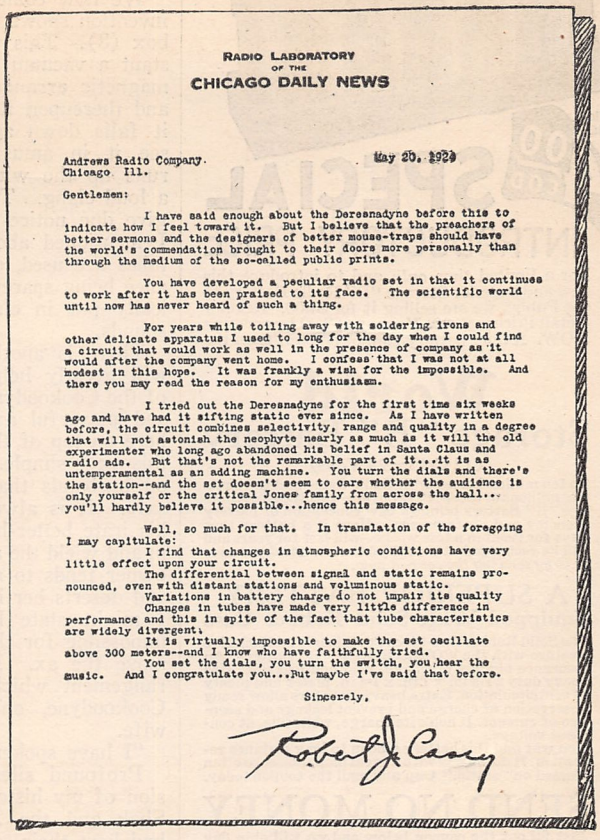

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Gentlemen:

I have said enough about the Deresnadyne before this to indicate how I feel toward it. But I believe that the preachers of better sermons and the designers of better mouse-traps should have the world's commendation brought to their doors more personally than through the medium of the so-called public prints.

You have developed a peculiar radio set in that it continues to work after it has been praised to its face. The scientific world until now has never heard of such a thing.

For years while toiling away with soldering irons and other delicate apparatus I used to long for the day when I could find a circuit that would work as well in the presence of company as it would after the company went home. I confess that I was not at all modest in this hope. It was frankly a wish for the impossible. And there you may read the reason for my enthusiasm.

I tried out the Deresnadyne for the first time six weeks ago and have had it sifting static ever since. As I have written before, the circuit combines selectivity, range and quality in a degree that will not astonish the neophyte nearly as much as it will the old experimenter who long ago abandoned his belief in Santa Claus and radio ads. But that's not the remarkable part of it...it is as untemperamental as an adding machine. You turn the dials and there's the station--and the set doesn't seem to care whether the audience is only yourself or the critical Jones family from across the hall... you'll hardly believe it possible...hence this message.

Well, so much for that. In translation of the foregoing I may capitulate:

I find that changes in atmospheric conditions have very little effect upon your circuit.

The differential between signal and static remains pronounced, even with distant stations and voluminous static.

Variations in battery charge do not impair its quality

Changes in tubes have made very little difference in performance and this in spite of the fact that tube characteristics are widely divergent.

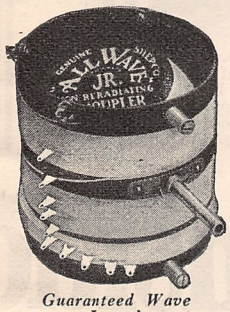
It is virtually impossible to make the set oscillate above 300 meters--and I know who have faithfully tried.

You set the dials, you turn the switch, you hear the music. And I congratulate you...But maybe I've said that before.

Sincerely,

Robert J. Casey

The accompanying letter is an additional endorsement, and is typical of many that have been received from men prominent in radio.



Distance, Volume and Selectivity a Certainty

BUILD YOUR OWN SET

with the Genuine Guaranteed

"SHEPCO" "ALL WAVE" Jr.

Non-Radiating DX Coupler

TRADE MARK—PATENTS GRANTED AND PENDING

Combination Flat and Bank wound

Guaranteed Wave Length
150 to 1000 Meters in single circuit
150 to 700 Meters in triple circuit

At Radio Dealers or Sent Prepaid on Receipt of Price **$6**

Gives all the selectivity of tuned radio frequency at a small fraction of its cost. Users declare it "the finest tuning unit in existence." Bulid your set the "SHEPCO" way and we guarantee results. The "All Wave" Jr. Coupler may be used in single, double or triple circuit. Guaranteed to bring in stations 1500 miles distant clear and loud on one tube. Exclusive tapped and bankwound primary and tapped secondary give the supreme efficiency of elaborate honey comb coil outfits. Guaranteed not to radiate in "SHEPCO" triple circuit. Short aerials no handicap.

6 efficient hook-ups in every box or sent for 10 cents in stamps to cover mailing cost.

OR HERE'S OURS READY BUILT

"SHEPCO" "All Purpose" Receiving Set

Trade-Mark—Patents Granted and Pending

A ready built one tube receiver incorporating "SHEPCO" "All Wave" Jr. Coupler and other highest quality parts. You could not buy the parts alone at the price of this expertly assembled, guaranteed-to-operate set. At your dealers or sent prepaid on receipt of price. **$21** without accessories

"Shepco" Products are made and backed with an Absolute Money Back Guarantee by

SHEPARD-POTTER COMPANY, Inc.

Plattsburgh, N. Y.

A wonderfully selective distance getter with volume equal to one step of audio frequency. Ideal for novice or expert. Simple to operate. Exclusive terminal arrangement permits rapid change of hook-ups so any desired circuit may be used. Hookup chart furnished. Will operate loud speaker on nearby stations. Beautifully finished genuine mahogany cabinet.

"SHEPCO" Two Stage Audio Amplifier in genuine mahogany cabinet, for use with "All Purposes" or any other set. **$21** without accessories

12 Cells
24 Volts

$4.00 C.O.D. SPECIAL

INTRODUCTORY PRICE

For a limited time *only*, and to introduce this new and superior Storage "B" Radio Battery to the Public, we are selling it for $4.00. Regular Retail Price is $6.00. You save $2.00 by ordering NOW. A finer battery cannot be built than the

World
Storage "B" Battery
(12 Cells—24 Volts)

To ten million homes with Radio Sets—and to countless millions of prospective buyers—this WORLD Storage "B" Battery brings a new conception of battery economy and performance. Here is a battery that pays for itself in a few weeks—will last for years and can be recharged at a negligible cost. *And you save $2.00 by sending the coupon now.*

A SUPERIOR BATTERY
Equipped With Solid Rubber Case

The Solid Rubber One-Piece Container is an Exclusive Feature with the WORLD Storage "B" Battery. An insurance against breakage, acid and leakage. Has heavy duty 2 1-8 in. x 1 in. x 1-4 in. plates and plenty of acid circulation. Extra heavy glass jars allow ready observation of charge and prevent leakage and seepage of current. It holds its charge, while idle, at constant voltage.
You will find this battery a boon to long distance reception. It does away with a great many noises so often blamed on "static." Clip and mail the coupon today.

SEND NO MONEY

Just fill out the coupon below and we will ship day order is received. EXTRA OFFER: 4 batteries in series (96 volts), $15.00. Pay Expressman after examining batteries. 5 per cent discount for cash in full with order. Send the coupon NOW and save $2.00.

WORLD BATTERY COMPANY
Makers of the famous World Radio "A" Storage Battery
1219 S. Wabash Ave., Dept. 75, Chicago, Ill.

This Coupon Is Worth $2.00
Clip and Mail It NOW!

WORLD BATTERY CO.
Dept. 75, 1219 So. Wabash Ave., Chicago, Ill.
Gentlemen: Please ship the following, Express C. O. D., Subject to Examination: .....World Storage "B" Batteries. Price, $4.00 each, or $15.00 for a complete set of four batteries (96 volts) in 24-volt units.
Name.....
Address.....
City and State.....

FREE!

Radio "Applause Cards"*

"— — Station W-E-A-F signing off. If you have enjoyed the artists' program, won't you write in and tell them?"
By all means! Quickly and easily with "Applause Cards"*. They're handsomely printed mailing cards. All ready for you to fill in with your comments, sign, and drop in the mail box.
Keep a pack of them near your receiving set. You can use "Applause Cards"* liberally because they are FREE AT YOUR RADIO DEALER'S.
("Applause Cards"* were originated by this Company, makers of the popular Dictograd Loud Speaker and the Aristocrat Dictograph Headset. The only "Applause Cards"* are Dictograph Copyrighted "Applause Cards"*.)
A big FREE package of them awaits you at your dealer's. Or if he has not yet stocked, we will send you a large package of "Applause Cards" prepaid direct to you, providing you will furnish us with your dealer's name. Dept. D-9.

DICTOGRAPH
PRODUCTS CORPORATION
220 West 42nd Street, New York City
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One Charger for All Batteries

Charges 2-volt peanut tube batteries, 6-volt A Batteries, 6- and 12-volt automobile batteries, and 1 to 4 B Batteries. It's the
Valley Type ABC Battery Charger
VALLEY ELECTRIC CO., St. Louis, Mo.

mates. I have several patents pending on this invention in most civilized countries.

We now come to another masterpiece of invention shown to the extreme right of the box (8). This works as follows: The instant a vacuum tube blows out, an electromagnetic arrangement lifts up the hammer and thereupon it is released by a pawl and it falls down again. The weight, as you see it in amusement resorts, immediately runs up the wire and hits bell (18) with a loud clang. This arrangement is made to give due notice of the blow-out of a tube. I mentioned above that not all of the 16 tubes are used, only 11 being used, the balance being spares. The spares are automatically put in circuit the minute bell (18) sounds.

There is another important utility which will greatly help all wives of the owners of the Cookoodyne. It is a new nickel plated and powerful ax (5) which you will see here on top of the cabinet. The purpose of this ax is simple. It constantly serves notice on husbands that the Cookoodyne is never safe. It is always a warning to him that his irate better-half might at any time rush in and wield the ax on the Cookoodyne if the owner tends to neglect his former playmate and deserts her in favor of the Cookoodyne. I might state here in passing that it is impossible for the ingenious husband to remove the ax. It has a secret locking arrangement which the salesman, selling the Cookoodyne, only entrusts to the buyer's wife.

"I have spoken."

Profound silence reigned at the conclusion of my historic speech. I looked at the Shah and the Admirals who, up to this, had kept their seats, but who now all began to make a rush for me. I saw the weather signals in time and the ink-stand which the All-Highest hurled in my direction. This to me was the sign that the Cookoodyne was not exactly what the Chief had had in mind. I just managed to upset the handiwork of my seven days' labor and threw it into the path of the onrushing army. I gave the tea wagon a push, jumped upon it and just managed to slide into the express elevator in its downward journey.

I am puzzled and hurt. Perhaps the boss has an idea that he wanted an outfit with golf sticks, golf balls, tennis rackets, fishing tackle and a couple of footballs thrown in for good measure. If he had any such idea he will be disappointed.

I STILL THINK THE COOKOODYNE IS THE BETTER OF THE TWO IDEAS.

New Radio Patents

(*Continued from page* 343)

FILAMENT SUPPORT FOR TUBES

(Patent No. 1,486,432, B. Hodgson and S. R. Mullard. Filed Aug. 22, 1921, issued March 11, 1924.)

SUPPORT FOR FILAMENTS IN THERMIONIC VALVES AND OTHER TUBES wherein a spring is interposed between the filament and a point on the glass envelope whereby the spring maintains a uniform tension on the filament during abnormal heating of the envelope.

CONSTANT FREQUENCY GENERATOR

(Patent No. 1,486,505, K. W. Wagner. Filed June 28, 1923, issued March 11, 1924. Assigned to Radio Corporation of America.)

STABILIZING OSCILLATION GENERATORS wherein a plurality of load circuits are connected with the generator and arranged to maintain the frequency delivered to a work circuit at a constant value.

CONSTANT FREQUENCY GENERATORS

(Patent No. 1,486,506, K. W. Wagner. Filed June 28, 1923, issued March 11, 1924. Assigned to Radio Corporation of America.)

STABILIZING OSCILLATION GENERATORS functioning at a particular working frequency. A primary load which is substantially

The Original, Authentic Five Tube Cockaday

Once a Cockaday fan, always a Cockaday fan. The reason is because the Cockaday has a certain clarity and ease of operation that makes a hit with every owner. Here's the new Cockaday, the latest model. The improved 5 tube model with the new system of push-pull amplification that puts this Receiver in a class apart from many receivers of its size and type.

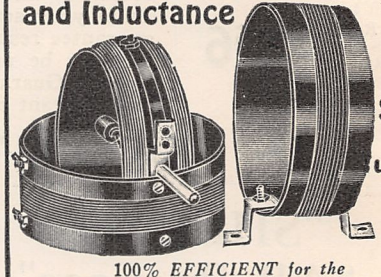
Build It Yourself

With the New "CONSRAD" Pattern No. 11. A complete instruction pattern on the Original, Authentic Improved Cockaday. Pattern contains simple, but complete instruction on a 4-page pamphlet with large size, 18"x21" blueprint enclosed in a handsome two-color 9" x 12" folder.

PATTERN No. 11 — PRICE 50c. PREPAID. SOLD BY ALL RELIABLE RADIO DEALERS. If your dealer cannot supply you, write direct enclosing 50c and we will mail you the pattern by return mail.

Consrad

EASTERN COUPLER and Inductance



Price $6.00
An Unrivalled Value

100% *EFFICIENT for the*
SUPERDYNE CIRCUIT

This circuit, which uses only four tubes, is the ONLY RIVAL of the SUPER-HETERODYNE and surpasses all other circuits for all around efficiency.
Radio engineers all endorse the EASTERN COUPLER for maximum results with the Superdyne Circuit.
Wound with double silk wire on genuine bakelite tubing, with moulded rotor.
This circuit is less expensive to construct than most 3 tube sets.

Picture hook-ups and material list FREE with each coupler.
Mail Orders Filled. *Dealers Communicate.*
EASTERN COIL CORP.
22 Warren St. Dept. R.N. New York, N. Y.

Insure your copy reaching you each month. Subscribe to RADIO NEWS — $2.50 a year. Experimenter Publishing Co., 53 Park Pl., N.Y.C.

independent of the working frequency is connected to the generator with a filter for excluding secondary or undesired frequencies connected between the generator and the load. A supplemental stabilizing load consisting of an oscillation circuit excluding the working frequency, but imposing an increased supplemental load on the generator at nearby frequencies is also connected to the generator whereby the operating condition of the generator tends to remain constant.

DUPLEX RADIO CONTROL

(Patent No. 1,486,885, J. H. Hammond, Jr. Filed July 30, 1915, issued March 18, 1924.)

RADIODYNAMIC DUPLEX SYSTEM wherein electromagnetic waves having contrasting characteristics are transmitted for operating a distant control apparatus.

DISTANT CONTROL SYSTEM

(Patent No. 1,486,886, J. H. Hammond, Jr. Filed June 3, 1914, issued March 18, 1924.)

SYSTEM FOR TELEDYNAMICALLY CONTROLLING MOVING BODIES at the same time that a visible signal carried by such body may also be controlled by radiant energy.

RADIO SIREN TRANSMITTER

(Patent No. 1,486,887, J. H. Hammond, Jr. Filed July 13, 1914, issued March 18, 1924.)

ELECTRORADIANT SIREN where signals are transmitted over a varying range of wavelengths. The transmitter contains a pair of variable inductance devices which may be continuously operated to maintain the primary and secondary circuits in resonance over a varying scale of frequencies.

STATION CALL APPARATUS

(Patent No. 1,487,012, H. Chireix. Filed Aug. 29, 1921, issued March 18, 1924.)

CALLING ARRANGEMENT FOR SIGNALING actuating a call indicator in a receiving station in response to a plurality of operations that follow each other in a predetermined cycle. A mechanical system is provided at the receiver, including two isochronous pendulums. One of the pendulums is accelerated by the predetermined order of calling signals and then the differential movement of the two pendulums causes an indicating device to be actuated.

FIXED CONDENSER

(Patent No. 1,487,096, L. F. Fuller. Filed June 16, 1919, issued March 18, 1924. Assigned to Federal Telegraph Company of San Francisco.)

ELECTRICAL CONDENSER of the stack type, having a round edge shield at each end.

M-B-G

RADIO CABINETS

ARE CONVENIENT

Radio cabinets—large ones—small ones just the kind you want—the kind that finish off your set, make it look better and work better—because it's always protected. M-B-G Radio Cabinets are nicely grooved to fit the panel. They're made of Oregon Fir selected for its perfect grain. That's why thousands of fans are ordering them each day.

Send Your Order

Select the model and size you need and just send your order direct to us—or ask your radio dealer. We will forward it to you promptly, postage prepaid. FREE with every cabinet comes complete and fascinating instruction on how to stain to harmonize with any color scheme or furniture. You finish M-B-G cabinets to suit your taste—that makes them especially convenient.

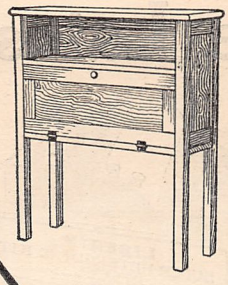
EVERY M-B-G RADIO CABINET IS GUARANTEED TO GIVE SATISFACTION OR MONEY WILL BE CHEERFULLY REFUNDED.

Radio Cabinet Dept.

Express Body Corporation

42 Lake Street

Crystal Lake, Illinois



CABINET No. 37
Exceptional design, compartment 10"x11"x29" for batteries, etc., and shelf for instruments 7"x11"x29" overall measurement 11½"x32"x37". Complete packed in carton.
$11.50

Open back with shelf compartment for "B" battery. 10"x11"x29". Paneled front to conceal batteries, overall measurement 11½"x32"x29". Complete in carton.
$7.50

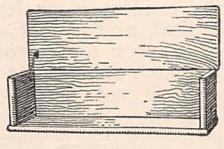
Table No. 31
Substantial table with shelf 15"x31"x29" sold with legs removed, easily screwed in place. Packed in carton.
$3.00

K. D. CABINETS

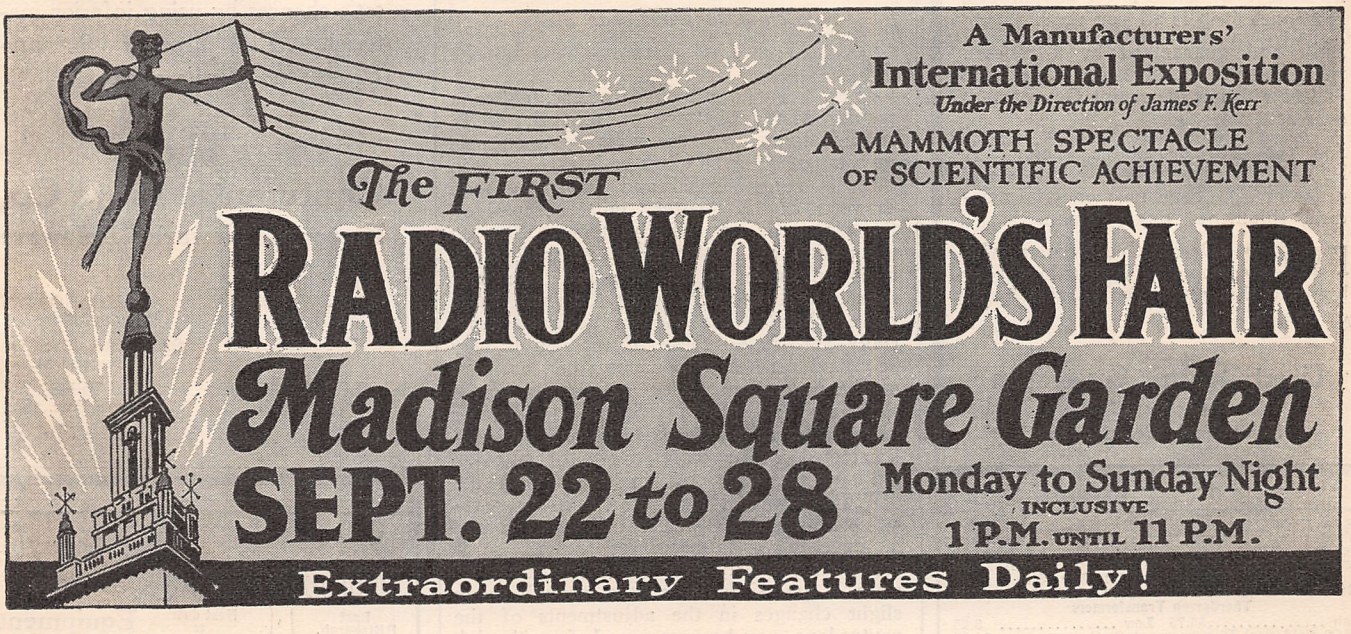
Made in a variety of sizes, sold knocked down easily assembled, no other cabinets offer such unusual values—

Panel 7x9"	7" deep	$1.50
Panel 7x12"	7" deep	1.80
Panel 7x16"	7" deep	2.00
Panel 7x18"	7" deep	2.10
Panel 7x21"	7" deep	2.20
Panel 7x24"	7" deep	2.30
Panel 7x26"	7" deep	2.40
Panel 7x28"	7" deep	2.50

Other sizes carried in stock. Prices on request.



Express Body Corp., Radio Dept.
42 Lake Street, Crystal Lake, Illinois.
Please send me model.....
size ..... for which I enclose $.....
Name .....
Address .....
.....



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Representative Displays by the Famous Manufacturers of

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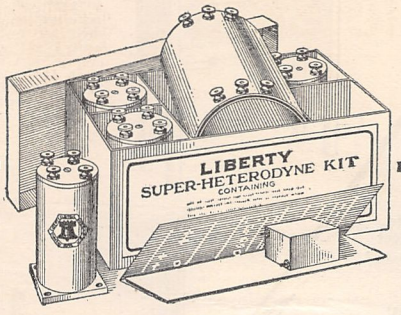
The Latest



Only $27.50

You can get many more stations by installing the Liberty Super-Heterodyne R-40 Kit as the heart of your outfit. Quickly and easily assembled with other standard parts.

The Liberty Kit insures super-sensitiveness in your receiver and its unusual sharpness enables you to pick up most any station. Easy to tune. Think what this Super-Heterodyne adds to your pleasure.

Build or Re-build

You easily build your own receiver by following blueprints and instructions we furnish FREE. Complete wiring diagram. Simple, accurate, easy to understand and follow. An entirely new outfit on a panel 8 by 28 inches; or, at small cost, re-build your old outfit to have all these latest advantages. A 17-inch loop is all you need.

Built and guaranteed by a concern with five years' successful experience and now filling important Government contracts.

Ask the nearest reliable dealer. If he hasn't a Liberty R-40 Kit in stock, order direct. Send no money. Immediate shipment. Pay postman.

FREE—Descriptive circular with complete instructions for building this set if you furnish name of dealer.

Liberty Electric Corporation
Department 209
Stamford, Connecticut

$18.50 Kodel Portable Radio Receiver, complete with UV199 tube, Eveready "A" and "B" Batteries and Phones $27.00
Super B Battery, 12 cells—24 volts Rechargeable 4.50
Genuine Bakelite Cut to Any Size
3-16 in. .02c. ⅛ in. .01½c. ¼ in. .03c. per sq. inch
Thordarson Transformers
High .....$3.75 Low 3.25
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Remittances Must Include Postage
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8 TUBE SUPER HETERODYNE
Complete parts and engraved panel for building Radio Receptor 8-tube Super Heterodyne **$110**
FRIEDLANDER-KOPPLE RADIO SERVICE
149 Church Street New York City

Insure your copy reaching you each month. Subscribe to RADIO NEWS—$2.50 a year. Experimenter Publishing Co., 53 Park Pl., N.Y.C.

An Emergency Transformer

(*Continued from page* 315)

A ⅛-h.p. 110-volt motor used for this purpose gave the following results at full load: Plate voltage 480 volts, filament voltage nine volts, with series fields in multiple. This supplied two 5-watt tubes. The efficiency due to the core loss in the solid poles and the air gap was very small. The input at full load was 380 watts. Although high for the output, this would not tax the house service.

A Two-Stage Solodyne Audio Frequency Amplifier

(*Continued from page* 332)

Should distortion occur in the last tube a larger condenser across the phone terminals will cure the trouble. The two telephone jacks will be found useful in testing out each stage separately to determine if the two transformers are connected properly.

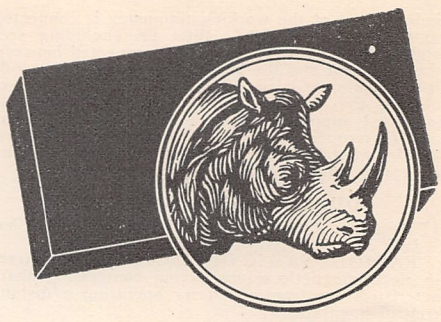
Further improvements in reproduction may be had by loading the secondaries of the transformers either with condensers or resistances. In either case the values of the condensers or leaks will be somewhat critical, as they not only have a smoothing effect upon the reproductions but also alter the pitch of the note in the loud speaker if care is not taken.

Neutrodyne Receivers

(*Continued from page* 317)

former. A six-volt "A" battery, either a regular storage battery or four dry cells, reduced to below three volts by a suitable rheostat of 50 or 60 ohms resistance on each tube, is recommended and not more than 45 volts of "B" battery must be used on the plates of any of the tubes. Due to the design of factory-made neutroformers, it is advisable to use standard size tube sockets with adapters to fit the small tubes rather than to use sockets designed especially for these tubes. Even then it may be found necessary to connect one or more of the neutrodon condensers directly across the grid and plate terminals of one or more tubes to prevent oscillations. A milliammeter, with a scale reading of 10 to 50 milliamperes connected in series with the "B" battery will greatly aid in properly adjusting the set. No great difficulty should be experienced in adjusting the set so it functions properly over the entire range of class B and C wave-lengths, though many slight changes in the adjustments of the neutrodons may be necessary before the job is finally complete.

Where very short aerials are used, the first neutroformer should be replaced by a fixed coil, as described before, in which case only three neutroformers will be required. Such an arrangement, plus two stages of audio frequency amplification, has given loud speaker reception with fair regularity during the winter months from stations 1,000 and 1,500 miles away, using an inside aerial less than 20 feet long and not over 10 feet above the ground It is, however, recommended that for better results the audio frequency tubes be either UV-201As or C-301As in conjunction with



Tough

Bakelite-Dilecto has astounding mechanical strength; yet it is easily cut into perfect radio panels. Used by foremost radio set manufacturers.

bakelite Dilecto
(A Laminated Phenolic Condensation Material)

Resists heat, cold, water, oil, steam, solvents and all weather elements. Highest in dielectric strength. Always satisfies. Don't spoil your set's chances by using inferior material. *Tell genuine Bakelite-Dilecto now by its red stripe.*

The Continental Fibre Co.
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The Set Which Copied
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on
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ELGIN RADIO SUPPLY CO.
207 E. Chicago Street, Elgin, Ill.

Get a Handy Binder for your RADIO NEWS. Holds and preserves six issues, each of which can be inserted or removed at will. Price 65c. Experimenter Pub. Co., Inc., Book Dept. 53 Park Place, New York.

an extra 22½- or 45-volt "B" battery. Such a set is shown in the accompanying photographs. With one stage of audio amplification signal strength of distant stations is equally as great as on a regular five-tube non-regenerative, two stage audio set. The advantages of clearness, freedom from tube noises, decrease in the strength of static, etc., when only one stage of audio amplification is used, is not to be overlooked.

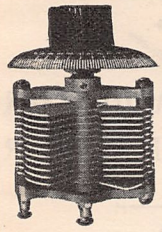
AMPLIFICATION

Two stages of amplification are, of course, necessary for good reception from far distant stations, or for reception of distances over 100 or 150 miles in the daytime on a loud speaker. No better key to the clarity and volume of reception is necessary than the plate milliammeter already mentioned. Not only will it tell when the circuit is ready to break into oscillation, either in the radio frequency circuits as described, or by too much regeneration in the detector circuit by a drop or wave motion towards the zero end of the scale, but it will tell you the instant the audio frequency amplifiers are becoming overworked and distorting on the brink of signals by a wavering towards the maximum position of the scale. This will be indicated some time before the average listener can detect the distortion, or at least before it becomes at all serious. For good pure *undistorted, understandable music,* the plate milliammeter should always remain practically stationary. Then, and only then, can the operator be certain the set is reproducing just what is being sent out by the transmitter of the distant station.

After a six tube set as described has been put in excellent working order and the builder feels he is capable of going a step further, and if a storage battery is at hand for the "A" battery, the UV-199 or C-299 tubes may be taken out of the radio frequency sockets and their places filled by UV-201A or C-301A tubes and the detector tube may be replaced by a UV-200 or C-300 detector, by changing the detector rheostat, or any tube desired may be used as the detector.

Using the plate milliammeter for a guide, as before, the circuits are again carefully adjusted, first starting on the longer waves, say about 500 meters, adjustments are made until the radio frequency circuits cannot be made to oscillate under any condition. Then gradually drop down the scale to 475 meters and then to 450 meters, etc., and repeat the process until all trace of oscillations in the radio frequency circuits is eliminated.

No trouble should be experienced in tun-



The
PROUDFOOT
Condenser

Losses Cannot Be Measured!

Think of it—nearly 100 per cent efficiency in condenser service! You have to see the Proudfoot to appreciate its watch-like precision and accuracy. Two-point stator plate mounting (instead of the customary three-point), wiping contacts and fine bronze bearings all contribute to its superior quality and put it in a class by itself in the field of condensers.

One Knob Vernier and Group Plate Control

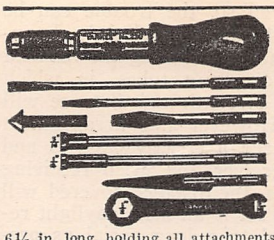
You can even log your vernier adjustment on the Proudfoot. There are two separate scales on the dial that make this possible and complete tuning is ingeniously done with one knob. No more "will-o'-the-wisp" tuning.

Try One On Your Set

You'll marvel at results. And the Proudfoot costs no more than any reliable condenser. 13 plate (M.F.C. .00025), $3.75; 25 plate (M.F.C. .0005), $4.50; 43 plate (M.F.C. .001), $5.75. Accept no substitute. If your dealer cannot supply you, write us.

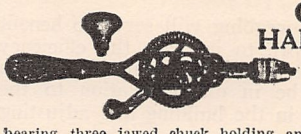
CRUVER MANUFACTURING CO.
2456 W. Jackson Blvd. Chicago, Ill.

USE "RAGECO" TOOLS TO BUILD BETTER RADIO SETS



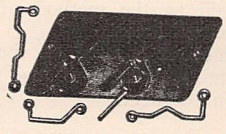
CR-701 RADIO TOOL SET

This is the handiest set of tools ever made for Radio Work by the makers of the famous "YANKEE" Tools. It contains the following: 1 Rachet Screw-driver, 6½ in. long, holding all attachments; 1 Blade, 5½ x 3/16; 1 Blade, 3½ x ⅛; 1 Blade 2½ x ¼; 1 Countersink; 2 Socket Wrenches for all small nuts; 1 Reamer to enlarge holes in panel from ⅛ x ½; 1 Wrench, one end 5/16" square or hex. for jack, other ½" hex., etc.
Price per set $3.00



CR-303 HAND DRILL

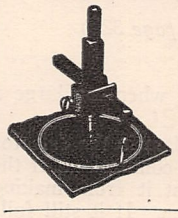
The hardwood handle is hollow to store drills. Iron frame, nickeled parts, ball bearing three jawed chuck holding and centering accurately round shank drills from 0 to 3/16. Length of drill, 12 inches.
Price $2.25



CR-203 WIRE BENDING TOOL

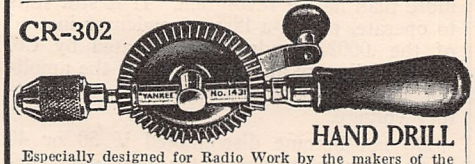
For making eyes, loops, bends, and offsets on Bus Bar wire. With this device any Radio Constructor can wire his set to compare favorably with any factory made set. Easier to use and more accurate than pliers. Full directions in box. Made of heavy steel, blued and finished.
Price $1.00

CR-402 CIRCLE CUTTER



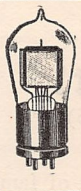
Especially designed for the Radio Constructor. Made of the finest material and equipped with the highest grade high steel cutting bits. It does three things at once. It drills its own pilot, cuts out plug and puts bead or scroll around the hole in one operation. Cuts holes ¾ to 4 in. in diameter.
Price $3.00
CR 401. Same tool but smaller and not fitted with bead or scroll in one operation.
Price $2.00

CR-302



HAND DRILL

Especially designed for Radio Work by the makers of the famous "Yankee" Tools. A beautiful balanced, small, powerful drill, with 4 to 1 ratio of gears for speed. Special chuck 9/32" capacity, to take largest drill, mostly furnished with drill or tool sets. Length over all, 9½ in. Weight 1½ lbs.
Price $2.75



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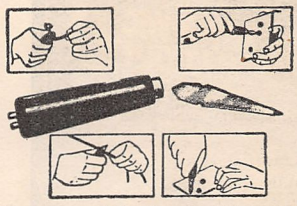


CR-702 RADIO HANDI-TOOL

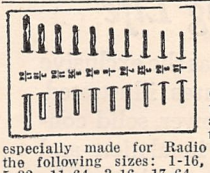
Bends Bus Bar or wire strips and scrapes wire, bores and reams holes, etc. Tool consists of 4" black japanned handle, to which is attached wire bending device, with nickeled ferrule and 3" long two sided reamer.
Price 50c

CR-703 TOOL CHEST

Set consists of "LOCK-GRIP" master handle, 5" long, black Rubberoid finish with steel chuck, nickel plated, buffed and with the following 9 tools: Saw, bradawl, large screwdriver, file, scratch awl, gimlet, reamer, chisel, small screwdriver. Each tool of fine steel, drop forged, tempered, hardened, and nicely finished. Set comes in leatheroid box with tray.
Price $1.85

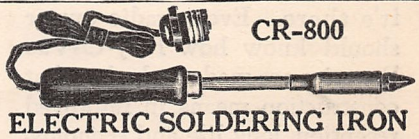
CR-304 SCREW STARTER and DRIVER

Holds any screw by its slot with a firm grip, makes it easy to place and start screws in difficult places. Just the tool for the Radio Constructor. All parts heavily nickeled and polished.
Price $1.00



CR-305 RADIO DRILL SET

Composed of 10 straight shank twist drills, fitting all hand and breast drills. The selection of these drills has been especially made for Radio Constructors and consists of the following sizes: 1-16, 5-64, 3-32, 7-64, ⅛, 9-64, 5-32, 11-64, 3-16, 17-64. Drills are mounted on white Holland Linen with sizes clearly marked.
Price $1.25



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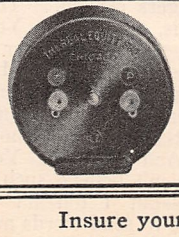

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ing down to 300 meters without serious effects from oscillations even when fairly strong signals are being received. Below 300 meters more serious effects will be noted and it is doubtful if the set can be made free from this trouble much below this point, but even so, the trouble can be avoided to a great extent by slightly detuning one of the dials or reducing the filament current on one or more tubes, in which case ample signal strength and distance will be maintained. However this arrangement should be considered a strictly class B and C wave-length receiver and when receiving from such stations, the distance covered will be great. Such a set is an ideal daylight receiver and coupled to a long aerial as previously recommended, stations having a 500-watt rating should be received up to a distance of 400 or 450 miles at midday during the winter.

I hope the foregoing will serve to benefit many who desire to increase the efficiency of their receivers, and I am sure the results obtained will be in direct relation to the care exercised in the building and adjusting of these sets.

Fig. 3 is the complete wiring diagram of a six-tube receiver. Locations of the meters, etc., are given, as well as the method of wiring the filament control jacks.

Exactly the same method is used on the other circuits in adding two stages of audio frequency amplification to them.

A Six Tube Receiver of Advanced Design

(*Continued from page 329*)

in the amperite burns out when too large a current is drawn.

If the set does not oscillate in the detector circuit, reverse the tickler connections, if the rotor has stops to prevent it from making more than half a revolution. If it still fails to operate, put in a larger condenser instead of the .00025 condenser designated by C6. If this fails, try another tube. If the amplifier sounds mushy, adjust with the "C" battery voltage.

Do not become discouraged if 30 or 40 stations are not logged the first night because a receiver as sharp as this one will probably skip right past the station until the operator becomes experienced and learns how to operate it.

Regulate or Bust!

(*Continued from page 306*)

doubtfully. "The name seems sort of familiar. What were you doing there?"

"Experimenting," said Jiggers. "I was experimenting and inventing things, if you know what I mean. I rigged myself up a laboratory and I worked hard, too. I had a great idea."

"What was it?" I asked him.

"Something to make the dwellers in those Sahara oases happy" Jiggers replied. "You know what a telephone is, of course. You can talk over a wire, or send music over a wire—that sort of thing. Well, I decided I would invent a way to send music and song and lectures and weather reports and time signals and all that sort of thing to those people on those oases. And I did it! You won't believe me—you won't believe such a thing could be possible—but I did it! I actually discovered a way to send words and music and all such things through the air without using a wire! And I'll say, Butler,

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The high cost of the portable radio receiver can be easily overcome by the "CONSRAD" method of "Building your own receiver" through the use of the "CONSRAD" Pattern No. 12. The receiver described is based on one of the latest and most efficient of the reflex circuits, comprising one stage of radio frequency amplification, one stage of audio frequency and detector, using only one tube in conjunction with a crystal detector. It is therefore virtually a three-tube set, capable of operating at good volume over substantial distances, an important factor in any portable receiver. The Consrad Pattern contains one 4-page pamphlet of directions written simply so that anyone can understand it, two ample blueprints size 16"x21", and a smaller blueprint for the front panel. Altogether they make up a complete set of material for the construction of a practical, highly efficient Portable Receiver that is easy to operate, selective and powerful. The instructions and blueprints are contained in a beautiful two color printed envelope size 9"x12".

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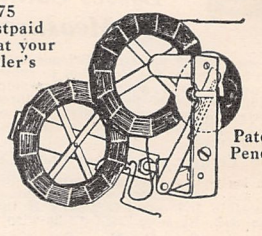

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even if it does sound conceited, that it was the most wonderful thing any man ever did invent. I called it radio."

"Radio!" I exclaimed.

"Yes," he said. "Some folks called it 'wireless'—because it had no wires. And we could send voices from one place to another by it. You can't understand how—you don't know anything about it, never having heard of it before—but it was wonderful. And concerts and lectures—we could send them, too. We had an arrangement that made waves in the ether, and the sounds traveled on the waves. We did it with electricity and electrons. You know what an electron is?"

"No," I said.

"Well, neither do I. Nobody does; all we know is that all electric charges are due to electrons—that all electric currents are electrons in motion. Why, all matter is electrons—that's what they say now. Cheese is just electrons arranged one way, and a chicken is just electrons arranged another way. So that's how we sent music and song—we agitated the electrons. And it was wonderful!"

I didn't like to tell the poor fellow that this was all old stuff to me and that we had radio in America. I told him it must have been wonderful.

"And maybe you think that when we sent music and song and entertainment out into the ether in that way it was lost?" asked Jiggers. "Not on your life! I looked out for that. As soon as I had the 'sender' invented I went to work and invented a 'receiver'—a sort of box with wires and crystals and things in it that would grab the radio waves out of the air and turn them back into music and song and bed-time stories and so on. And I invented a thing that hooked onto the 'receiver' and shouted the stuff out good and loud. I called that a 'loud speaker.'"

"Amazing!" I cried, for I hadn't the heart to tell the poor fellow we had that in America too.

"Amazing?" he said scornfully. "Why, that's no word for it—it was astonishing, astounding, overwhelming, epoch-making, revolutionary! It was tremendous. Nothing like it in the world ever before. Why—in a year or two every home in Sudania had a receiving set, and every town of any size had a sending station, and some had three or four. And those people on the oases! They had no reason to go out and commit suicide from loneliness any longer. They had music and instruction and entertainment right in their own little tents. A man could live in a hut in a wilderness and hear the zippiest orchestra in all Sudania. A man could be on a backwoods farm and hear a great preacher or attend a city prize-fight or be at a swell banquet. I tell you it was wonderful! It was civilization of the highest possible kind. Astounding!"

"Astounding!" I echoed.

"But it all went poof!" said Jiggers sadly.

"Poof?" I queried, not quite undstanding him.

"It all went poof," he repeated. "Went flooey. Went dead. Blew up. Whiffed out. It's gone. There isn't any more."

"But why?" I asked. "A splendidly fine thing like that, of no harm to anyone and of value to everyone—why did it poof and whiff, Jiggers? Why did it not last forever, a splendid thing like that?"

"Ah!" he exclaimed. "You don't know Sudania!"

"No," I admitted, "I don't."

"If you did," Jiggers said, "you would know anything as good as radio would be sure to go poof. You would know they would have to make rules and regulations. You'd know they couldn't refrain from doing what they are fondest of. You would know they would not be happy until they regulated a thing as important as radio right out of business."

When you stop for the night

Throw up an aerial and tune in just as if you were at home

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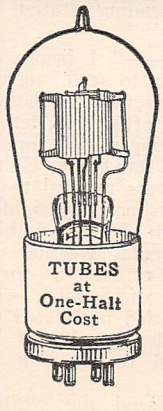

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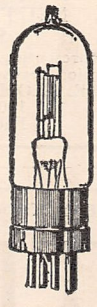

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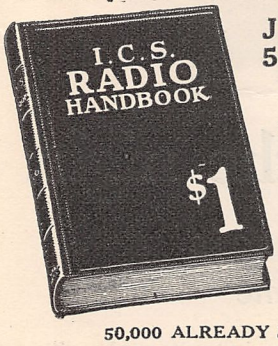

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"You don't mean to say they did that?" I asked.

"You don't know Sudania, I can see that," Jiggers said. "It's a queer country. No one cares whether a thing is of any value to others, or whether it gives others pleasure or adds to the general happiness. Not in Sudania. No, the first thing anyone thinks of is the Book of Rules and Regulations. Every family has a copy—'Eight Million Rules and Regulations, For Use On All Occasions and For All Purposes.' As soon as anything new comes up that is of any value to anyone, all the inhabitants of Sudania get out those books and begin going over the rules and regulations to see which they can apply to this new thing. When they find one, they write to the High Commissioner of Rules and Regulatoins, and he takes the Rule or Regulation and gets a sheriff or a policeman and goes down and applies the rule. I remember that the first thing we had to stop broadcasting was sonatas."

"Sonatas?"

"Yes; the Bill Posters' Union stopped them. A fellow had written a book entitled 'Son Otto,' and the Bill Posters' Union claimed that whenever our announcers said 'sonata' it sounded like 'Son Otto' and reminded people of the book, and that that was advertising and injured the Bill Posters. So we stopped sending sonatas. And then the Waiters' Union stopped us from broadcasting banquets—they said people preferred to stay at home and hear the after-dinner speeches there, and that that injured the waiter business. So we had to stop broadcasting dinners. Then the Guild of Sport Writers stopped us from broadcasting prize-fights and ball games, because they said we were reducing the number of their readers one forty-second of one per cent per annum. And then we had to stop sending bed-time stories."

"But why?" I asked.

"The Amalgamated Producers of Cod-Liver Oil stopped that," said Jiggers. "They had statistics to show that three out of every ten children used to lie awake and yell when put to bed, before we began to send bed-time stories, and they claimed that a sleepless child soon needed a tonic, and that our bed-time stories had reduced the sale of cod-liver oil by one-eighth of a cent per child per annum. And then the curator of the National Museum had the government reduce us to one wave-length—360 meters——"

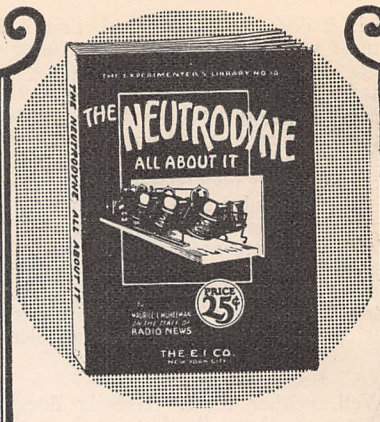
"Why did he do that?" I asked.

"The Museum wanted the other lengths," said Jiggers. "It was trying to get a complete collection of wave-lengths to put in a glass cabinet on the third floor. And, of course, if you *do* try to send a Y. M. C. A. talk and a jazz band concert and a prize fight and the weather reports and a tenor solo all at the same time on the same wave-length it does make a mean mixture. So the Society for the Protection of Aged and Infirm Ear Drums stepped in with Rule 546,354, and stopped that, and that cut us down to just one sending station in Sudania——"

"But, even one station——" I began.

"If we had had anything to send," agreed Jiggers. "The trouble was that the United Order of Copyrighters refused to let us send anything that was copyrighted, and as soon as they took that stand the United Society of Non-Copyrighters refused to let us send anything that was not copyrighted. That did not leave much—it left nothing but the official governmental weather reports and the time signals. And as forty-eight of the fifty states of Sudania were on Daylight Saving time and prohibited the sending of sun time under penalty of ten years in prison, we had to give up the time signals."

"But you could still send the weather reports," I reminded him.



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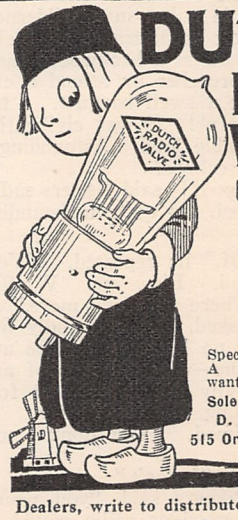

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Detector-Amplifier Guaranteed

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List Price $4.00

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Canada—Consolidated Electric Lamp Co., 43 Queen St. East, Toronto, Ontario

"Some of them," said Jiggers. "Some of them. The trouble was that the Smile Brightly Society enforced Rule 639,870, which makes it a misdemeanor to circulate anything unpleasant, and some of the weather reports were decidedly unpleasant. Late frosts and thunderstorms and hurricanes and falling temperatures in winter and rising ones in summer, for example. I remember ten days I spent in jail for broadcasting 'For tomorrow, rain in the Eastern portion of New Bloombia and Western Utumbia,' when there was a Sunday school picnic scheduled for the next day at Clay Center, New Bloombia. It was hard—very hard. We got down to the point where we could broadcast nothing but fine weather, and even then—if we happened to miss it and the day turned out to be rainy—we had to go to jail, because the Society for the Prevention of Misinformation stepped in and enforced the law against us. And then——"

Jiggers shook his head and sighed.

"Then what?" I asked gently, because I saw he was near tears.

"And then came the end!" said Jiggers. "The Society for the Prevention of Cruelty to Animals stepped in."

"But, look here, Jiggers," I said sternly. "You're spoofing me now. I've believed you up to this point, because—to tell you the truth—we have radio in this country, and I understand everybody is trying to 'regulate' it in one way or another, but this is a little too much for me to believe. What right had the Society for the Prevention of Cruelty to Animals to interfere? What were they interested in?"

"Electrons," said Jiggers sadly. "They brought a book, written by a distinguished scientist, and they pointed to a passage in it—'An electron is a particle which has a separate identity and individuality of its own What is still hidden from us is its intimate nature. We do not know what the electron itself is.' You see what that meant."

"No," I said, "I certainly don't see what that meant, Jiggers."

"Why, if nobody knew what an electron was," said Jiggers, "nobody knew that it might not be an animal of some sort. Like a cow or a microbe or an elephant one billionth as big as a speck of dust. It might even be some sort of chicken And Mr. Blootz—the President of the S. P. C. A. in Sudania was Henry K. Blootz—pointed out that the ether was full of electrons and that all electric currents were merely electrons in motion. He said that when we sent our agitations through the ether we were simply kicking those poor little electrons around and maybe kicking their poor little limbs all full of bruises and blacking their eyes and giving them headaches."

"But that is nonsense!" I exclaimed.

"Not in Sudania, it wasn't," said Jiggers. "We tried to fight them, but they went into court and their lawyer made a speech and drew a picture of the gentle little electrons, all seated at the dinner table and suspecting no harm—papa and mamma and the six little children, with dear old grandma in her padded chair eating mush and milk—and then our electric current coming whooping along through the ether and busting right into the midst of that peaceful electron family, kicking them forty-seven different directions. He made me weep, I'll admit that. He showed us dear old grandma lying flat on her back with one leg of the dinner table on her stomach and the bowl of mush in her eye, and papa electron hanging by one broken leg from the chandelier, and the poor little baby electrons wandering through space and all bruised and bleeding, crying for their mamma, and all the while that dear mother was being swept along through cruel cold space by a message that said 'For tomorrow, fair and

Perfect Mastery of Radio

MU-RAD RECEIVER
MA-15

"'This rug, my master' whispered the merchant to the third prince, 'will carry you wherever you will,—instantly. Simply express the wish and you are immediately transported.'"
—Arabian Nights Entertainment

SIMPLE as wishing. "Magic" made *real* in the new MU-RAD MA-15 RECEIVER. Programs from extreme distances easily selected with just *ONE* dial. The second dial controls volume. Louder distance reception. Everything you expect of radio and more.

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He arranges in orderly fashion the mass and jumble of Broadcasting Stations that are seeking entrance to your set and brings 'em in, one at a time, so you can enjoy them! Never reduces, but nearly always increases volume. Add a Ferbend Wave Trap to your set and "Police" your reception. Regulate the Traffic!

Guaranteed to tune out any interfering station. The price is $8.50. Shipment is made parcel post C. O. D. plus a few cents postage. If you prefer, send cash in full with order and we will ship postage prepaid. Send us your order today.

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FERBEND ELECTRIC COMPANY
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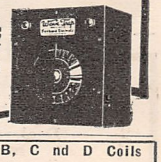

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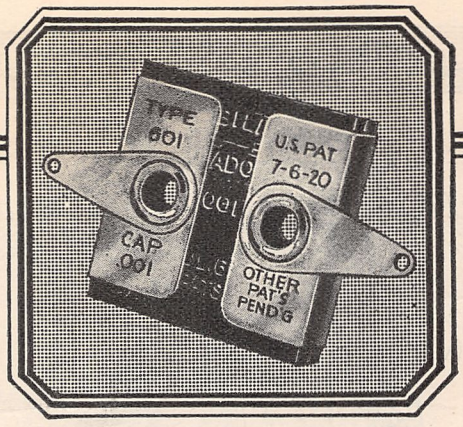

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A Test Every Man Past 40 Should Make

Medical authorities agree that 65% of all men past middle age (many much younger) are afflicted with a disorder of the prostate gland. Aches in feet, legs and back, frequent nightly risings, sciatic pains, are some of the signs—and now, a member of the American Association for the Advancement of Science has written a remarkably interesting Free Book that tells of other symptoms and just what they mean. No longer should a man approaching or past the prime of life be content to regard these pains and conditions as inevitable signs of approaching age. Already more than 10,000 men have used the amazing method described in this book to restore their youthful health and vigor and to restore the prostate gland to its proper functioning. Send immediately for this book. If you will mail your request to the Electro Thermal Company, 6037 Main Street, Steubenville, Ohio—the concern that is distributing this book for the author—it will be sent to you absolutely free, without obligation. Simply send name and address. But don't delay for the edition of this book is limited.

Western Office, Dept. 60B, Los Angeles, Calif.

warmer, slightly rising temperature in the Eastern portion of the district, light showers in the Western district.' So we surrendered. We quit. We gave up."

"And I don't know that I blame you," I said. "But didn't the people who owned the radio receiving sets complain? Didn't they rise in a howl when they found they were to receive your programs no more?"

"Why would they?" asked Jiggers rather blankly.

"Why wouldn't they?" I asked. "Weren't they getting all the best music, all the best song, all the best talks? Weren't they getting entertainment and instruction and pleasure? Why didn't they stand up and demand that the broadcasters of Sudania be allowed to continue broadcasting?"

"Well, they didn't," said Jiggers. "Not one of them uttered a peep. No one ever tried to help us; no one ever did anything but try to think up new and annoying regulations for us."

"But why didn't they?" I insisted. I was really worried about it. It did not seem reasonable that no one should have come to the assistance of Jiggers, when he was only doing what seemed to me a worthy thing. It seemed amazing to me that a whole nation should allow this wonderful thing to be hampered and choked, and not one person try to defend it.

I ordered another plate of corned-beef and cabbage for Jiggers, and he ate it slowly, thinking as hard as he could all the while. I could see that he was worried now; he had never tried to solve this problem. He was doing his best to solve it now. And he did solve it. A bright light began to glow on his face. He smiled. He hit the table a ringing blow with his fist.

"I have it!' he cried. "I know why those inhabitants of Sudania did not appreciate the tremendous thing we were giving them. I know why they did not appreciate it!"

"Why?" I asked him.

"They got it all free of charge," he said.

Waves, Wave-lengths and Inductance

(*Continued from page* 324)

regularly made instrument with plates. This capacity has an affect upon the period of the coil.

If the tuner could not be tuned, it is obvious that it would respond to only one frequency—or wave-length—and so would be capable of receiving only one station. This would be of little use. So we construct our receivers with coils having taps which may be used to vary the number of turns in them, thereby decreasing or increasing the inductance, and condensers in which the area of the plates facing each other may be varied, thus inserting more or less capacity into the circuit and so changing the natural period of the circuit.

When we tune a circuit we simply reduce the resistance of it to certain frequencies to a minimum by adjusting its natural period to the frequency wanted and at the same time increasing the resistance to all frequencies, except the desired one, to a maximum. For it takes several times the current to make a circuit vibrate at some frequency other than its own than is necessary at its natural frequency.

This again may be shown by the pendulum. It takes only the slightest push to start a pendulum vibrating, if it is pushed just at the proper time. It must be pushed just a little, once every second, in the case of the three-foot pendulum. If, however, we wish to make the three-footer vibrate, say, five times per second it would be necessary to grasp it and use main force for all the time it would be swinging out of rhythm or period.

It might be said here that the transmitting station tunes its sending circuits in the same manner. It uses one certain value of inductance and a certain value of capacity all the time so that its frequency remains constant. Each station—that is, where two stations do not have the same wave-length—has its own frequency which is used constantly. For the receiving station to pick up this station it is only necessary for the operator of the receiver to select such capacity and inductance by changing his condenser and switch taps as will make the period of his own circuit the same as that of the transmitter.

In the next article, the process of impressing the voice upon waves sent out by the transmitter will be discussed. Also certain points as to how the voice is recreated at the receiver by the detector, as well as other interesting facts concerning America's greatest indoor sport.

The Value of Radio to the Deaf

(*Continued from page* 304)

into the summer. A loud speaker was tried, but abandoned for two reasons: because our members on the whole did not hear with it comfortably and because the loud sounds literally stopped all business throughout the floor where our rooms are and also adjacent floors of our building. After more experimenting 24 head-sets for simultaneous use were installed. The southern half of our 70-foot assembly room was wired, with jacks at convenient intervals into which the plugs attached to the head-sets may be inserted. Then the fun began, and as the radio engineers keep on improving the receiving set we hear better and better with it.

We have all been astonished to find how many members can hear who thought their hearing was entirely gone. Another bit of fun has been our own experiments to make slightly deafened and seriously deafened enjoy the radio at the same time. Sometimes, to make the head-sets go farther, two people will take off the band that goes over the head and each one then listens in with one ear.

We think that in the whole history of the League nothing has given our members so much pleasure as radio. Of course, we all want to hear; nothing ever really comforts us for the loss of hearing. So hearing by radio just carries us off our feet. I want to urge other organizations to install one of these combination sets and let their members hear to their hearts' content..—*From the Volta Review, Washington, D. C.*

Honorable Oscillations

(*Continued from page* 307)

No! I reflex. It are not!

Because why, for following reason:

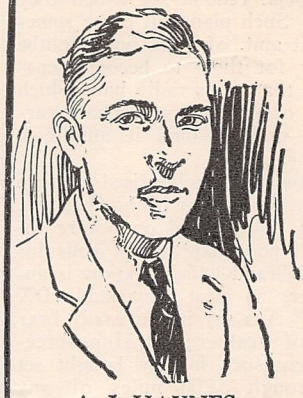
Most people which regenerate such howl are not radio hams which read hook-ups, etc. They are Hon. citizens which have bought set to be entertained by such. They do not know grid leak from tire puncture and if such tried to re-hook their set, same would produce nothing but static.

Also, such plan are not deep enough to help re-radiating situation at present for issuing cause; namely, squealing receivers still become sold in huge quantities.

Golden rule plan resemble idea to prevent men from becaming drunk by locking them up after they have done such. As soon as Hon. drunks are removed, more pepl. rush to take their places and also imbibe potent beverage.

Haynes-Griffin

RADIO SERVICE, Inc. 41 West 43rd St., N. Y. City



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Is your super heterodyne functioning as you think it should? Does it operate consistently and successfully on distant stations, pulling them in with the tone quality and volume that you expected? Above all, is it selective?

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Mail the coupon now to be sure of a copy of the first edition.

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"Super Success" has been written to help you get most of the other 60%. It contains the real secrets of super heterodyne construction, special information which A. J. Haynes and his corps of laboratory assistants have discovered regarding the use in combination of intermediate frequency transformers.

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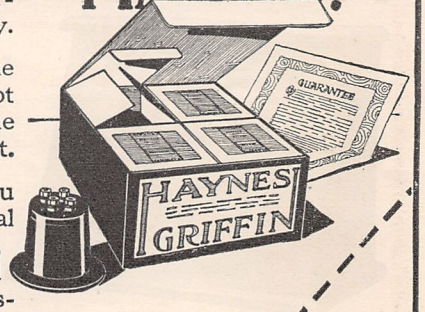

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Send me a copy of "SuperSuccess", also complete information and prices of the parts Mr. Haynes himself uses in his own super. I enclose 10c. to cover mailing costs.

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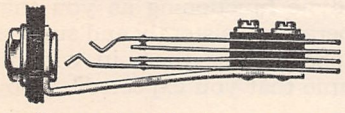

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Yaxley Radio Jacks are single nut mounting; fit any standard thickness panel without use of spacer washers. Have genuine phosphor bronze springs; pure silver, self-cleaning contact rivets and other exclusive features. Fit all plugs. Fully guaranteed.

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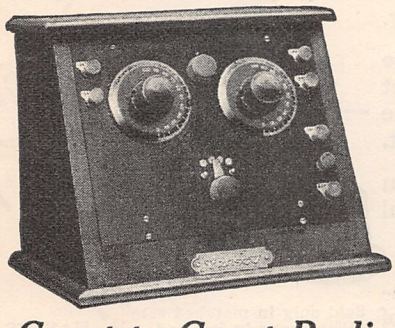

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for a short time only, send us your old crystal set and we will send you one of these beautiful tube sets for the small sum of $12.50; add P. P. on 10 pounds.

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QUALITY RADIO PARTS INSURE THE BEST POSSIBLE RESULTS FROM ANY TYPE OF CIRCUIT

Write for complete literature and prices

AMERICAN SPECIALTY CO.
BRIDGEPORT, CONN.

Such is Hon. Howl-squeal problem. As in other case, we must first catch squeal-making bootlegger, or else more pepl. will became howl-making radiatics faster than the present squealers are unregenerated.

Tuning out all interference from big words, Hon. Sir, we must first stop hugely salaried radio set makers from building such re-radiating pig squealers before we begin to make innocent pepl. rehook set which they already possess. Such plan will cause someone to lose great amt. of cash, but mightbe it will be easier for them to become separated from such than poor radio ham which has saved barrel of pennies to purchase varnished receiver—only to find it amplified, unmodulated squealer.

Many well known, also advertised sets are possessed with great groups of howl devils, and such should be operated on before insignificant set of poor ham which rolls his own. One Hon. brand which I know is announced in papers as most remarkable DX victim on earth. Ads say it can easily hear 3,000 miles in hot weather; but Hon. three-stage squeal from such largely bought set are audible through 3,200 miles of any weather.

"But," squeak ignorant man which wishes to buy high-power unhowling set, "how can we know non-squeal set when we see such?"

"You can't," I respond neutrodynely, "unless someone which knows such, tells you."

Which, Hon. Editor, are amplified priviledge of you and many others which are interested in squeal problem.

Such is unregenerated message of my heart to you, so I will close.

Tender reverences to all, including female variety, also office cat, which I trust are high-powered generator of static.

I remain extinctively,

CHIN CHOO CHOW,
Shanghai, Ariz.

KDKA's Powerful Short Wave Station

(*Continued from page 293*)

pole about 50 feet high. The antenna, which has a ball on its one end, is quite rigid, to prevent its swaying. Extremely fine results have been obtained from this perpendicular type of antenna. Though only one is now installed, there will be several erected at various points about the station to take advantage of the directional effects possible through the different locations.

Wonderful results have been obtained from broadcasting from the new site of the short-wave station. As an example, it is only necessary to state that daylight transmitting was successfully carried on between this station and station KFKX at Hastings, Nebraska, in order to repeat from Hastings, the Republican Convention proceedings at Cleveland and the Democratic Convention proceedings at New York. Such a feat of daylight broadcasting would not have been believed possible on any wave-length by radio experts a year ago. It is quite safe to say that there is no other station in the world now capable of doing such work.

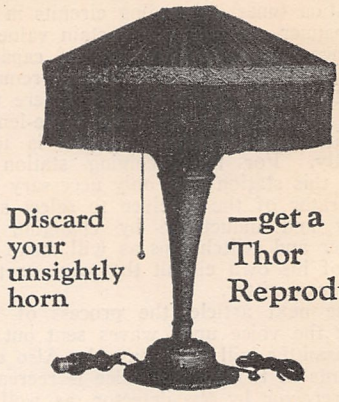
The Short Wave Receiver at WBZ

(*Continued from page 293*)

above the ground. The fact that it is so short and low improves its selectivity.

Two telephones are in the shack for communication with the studio, as well as a loud speaker to enable the operator to tell if everything is working right.

In the other end of the room is the equip-



Discard your unsightly horn —get a Thor Reproducer

¶ Non-directional reproducer. Gives perfect diffusion to all parts of the room. Handsome Electric Lamp with Silk fringed shade and polychrome base.

¶ *If your dealer can't supply you —order direct.*

Send for descriptive circular.

THOR Radio Department
Golden Gate Brass Manufacturing Co.
1243 Sutter St., San Francisco
(104)

—AND THEN HIS TUBES BURNED OUT!

This didn't need to happen! By connecting a Terlee "Ins-ur-tube" to each positive "B" battery terminal in use you can now provide 100% protection to your tubes. Accidental burnouts due to "shorts" within the set as well as misconnections are impossible. Equip your batteries today. For both storage battery and peanut tubes. Price $1.00 each.

Terlee Vario Couplers Cut Losses

High efficiency in radio parts—that's what you're after. Terlee Vario Couplers cut losses. Low dielectric losses and low distributed capacity increase selectivity and range. For both panel and table mounting. Type "S" for crystal and audion circuits—$6.00 each. Type "R" for regenerative and non-regenerative circuits using radio frequency amplification—$7.50 each.

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There's six 8½"x11" detailed blue prints in the set and every one is a winner. Every hook-up built and tested in our own laboratory. Get a set now. Price 15c set.

For best results, demand Terlee Products. If your dealer can't supply you, send your order direct to us.

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TERLEE

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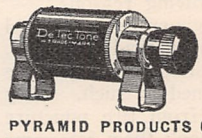

His goal—at last! Using a DE-TEC-TONE Crystal Detector in a 3-tube reflex receiver, 2-LO, London, was heard in Hannibal, Mo. It is not uncommon to get stations 1000 miles away on simple crystal sets with DE - TEC - TONE

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ment for short wave reception from Westinghouse station, KDKA, at Pittsburgh. The programs from Pittsburgh are sent out on a wave of 68 meters. The short wave apparatus picks it up and sends it into the station from the shack for broadcast.

It is surprising how few amateurs and radio fans appreciate that Westinghouse station WBZ is picking up the time signals from Arlington at the same time that it is rebroadcasting them, and that in spite of this simultaneous operation, with the receiving set right under the WBZ towers, no interference is experienced.

Coming Radio Expositions

(*Continued from page* 339)

tion to the space contracted for. Last year they received a return of nearly 25 per cent. of their show space fees, and there is every assurance that a still better return will result this year, for a much more extensive advertising and publicity campaign, as well as a more highly entertaining and instructive show are contemplated.

RADIO WORLD'S FAIR

The First Radio World's Fair, which is to be held at Madison Square Garden, New York City, Sept. 22 to 28, under the auspices of the Radio Manufacturers' Show Association, is attracting universal attention.

As nine-tenths of the exhibiting space in Madison Square Garden has already been contracted for, and as the remaining ten per cent is oversubscribed, it is practically a certainty that the exposition will be forced to spread out and take in the 69th Regiment Armory, located just across the street, upon which the R. M. S. A. has just taken an option. Notwithstanding the fact that the coming show will be for radio manufacturers of national reputation only, and the opening date is still several weeks off, Manager Kerr now has almost enough applications in hand to fill both buildings and new requests for space are coming in by every mail.

Among the new features to be introduced this season will be a "Foreign Division" in which many of the important radio interests abroad will be represented by carefully selected official exhibits. The European manufacturers and inventors are said to be making elaborate preparations for this, their initial invasion of America and they promise to furnish the radioists of this country with a few real surprises.

THE PACIFIC COAST RADIO SHOW

With exhibits by radio dealers and manufacturers of radio receiving apparatus from all parts of the country, the Pacific Radio Exposition to be staged in San Francisco August 16 to 21 is expected to become the most elaborate radio event ever held on the Pacific Coast.

The exposition will be conducted under the auspices of the Pacific Radio Trades Association and operated on a non-profit co-operative basis.

A. S. Lindstrom, of San Francisco, chairman of the executive committee of the exposition, states that it will be held in San Francisco's magnificent Civic Auditorium, and will be featured by displays of the most modern types of radio receiving sets, educational exhibits for radio fans, spectacular decorations and lighting effects and many novel forms of entertainment.

The spacious auditorium floor will be divided into 160 booths, with miniature radio towers serving as pillars or divid-

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BUILD YOUR OWN SUPER-HETERODYNE. Rebuild or convert your old set to a modern and advanced type Super-Heterodyne. All other parts required are standard. HOOK UP PRINT *and simple instructions packed with each* "PACIFIC QUINTET" KIT. Order from your regular dealer or

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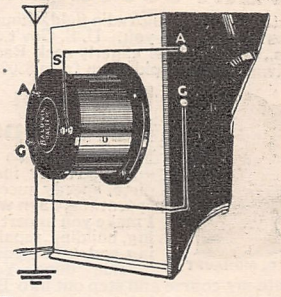
Make Radio a Pleasure with Baldwin-Pacific "NOISE FILTER" No. 15



No more "Night-mare" reception if you use this device. Electrical interference from high voltage lines, telephone wire disturbances, farm lighting plants, dynamos, elevators, generators, etc., completely eliminated.
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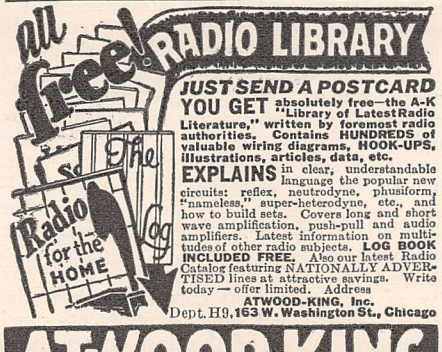

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ing posts between the booths, which will be connected by decorated aerials. Loud speaker horns on each tower for holding flowers will further carry out the radio decorative effect.

Special radio programs will be broadcast from the exposition by means of remote control through the various San Francisco Bay stations.

Afternoon and evening programs specializing in radio features will be held during the six days of the exposition for the public. Morning sessions will be held for the trade only, in which radio problems will be discussed.

It is estimated by Pacific Coast radio dealers and manufacturers that more than 50,000 people will attend the show.

In order that Eastern manufacturers and radio fans who will attend the exposition may enjoy radio programs while en route West, a special radio train, equipped with various types of sensitive radio receiving sets, will be run by the Southern Pacific Company from New York and Chicago to San Francisco. So numerous have become the applications for reservations on the radio special, it is expected that more than one train will be run to the exposition.

With the Amateurs

(*Continued from page* 308)

A NEW SHORT WAVE THEORY

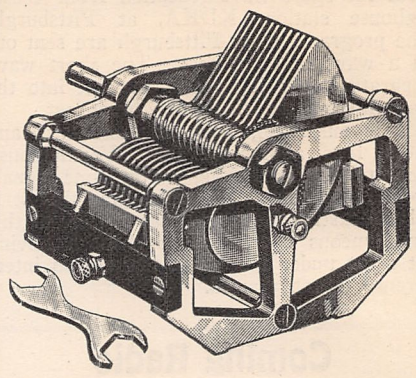
By "NAUTACORE"

There is a vast field for exploration on wave-lengths between 50 and 200 meters.

It seems, given darkness between two points many thousands of miles apart, communication is possible using only the smallest fraction of the power necessary in commercial work on longer wave-lengths. It occurred to the writer many years ago, when serving at sea, that it was very remarkable that one and a half kilowatts of power with a day range of about 150 miles should occasionally by night be sufficient to cross the Atlantic. Below 1,000 meters this freakish long-distance night transmission was very noticeable and, strangely enough, the shorter the wave, the greater distances covered with small power. It is remembered that it was possible at night, listening in on a ship cruising around the north of Scotland to hear destroyers in the Mediterranean Sea sending on about 200 meters. And there were no vacuum tubes in those days; just simple loose-coupled receivers with perikon detectors.

But while no satisfactory explanation was ever offered, it was noticed that a ship's emergency transmitter, usually a small induction coil, having a day radius of roughly five or six miles, behaved rather differently. If one and a half kilowatts with a normal range of 150 miles could cover 10 times that distance during the dark hours, the natural logical reasoning was that the emergency set, with its normal five-mile radius, should easily cover 50 miles by night. But it was not so. The emergency transmitter did not improve at all by night. It was observed in those days that by loading an emergency transmitter up to the limit of its capacity until its day range approximated 40 miles, it was possible to obtain long distance results by night. As far as the writer was concerned, there the matter ended, but later experiments, and particularly those of this last winter, have made it possible for him to suggest the theory given below.

It is possible to carry on communication with French amateurs, the transmitter using only three watts. It is common knowledge that Pittsburgh, KDKA. is audi-



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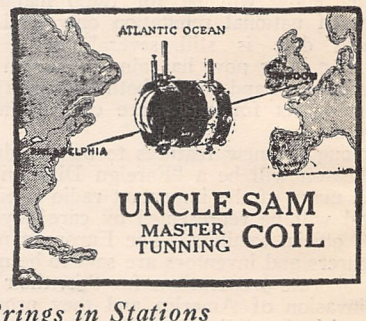
Quoting from front page of Philadelphia Inquirer: December 26th, 1923: "At about 10:57 o'clock Mr. ——— tuned in 2 L O (London)."



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ble in England to those who can tune successfully to 100 meters, though only a single-tube receiver be employed with regeneration. Small though the power may be in these nocturnal communications, below a certain power nothing can be done. While one transmitter may do wonderful things with three or four watts, another may be unable to accomplish anything creditable with less than 100 watts. The matter of long-distance, short-wave night communication, therefore, resolves itself into a matter of range. Different experiments have proved that power input or amperes in the aerial are very poor guides in this respect. Range is not a matter of amperes radiated. It differs widely at different stations and local conditions influence it greatly.

DAY RANGE NECESSARY

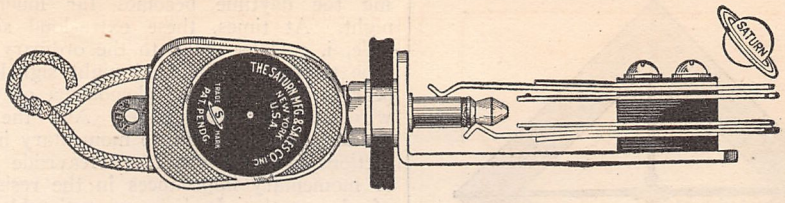
After comprehensive experimenting throughout the winter, it was found vitally essential, in order to accomplish long-distance short-wave transmission, to have at least a *normal day radius of* 30 *to* 40 *miles*. The reason the old-time ship's emergency transmitter would not do remarkable work at night, as would the main transmitter, was that the former had a day radius of far less than 30 miles.

In recent tests the receiver used was a single-tube regenerating into the aerial. The signals were sent in Morse with continuous wave. The wave-lengths used were from 100 to 300 meters. More power was required to accomplish a 30-mile daytime range as the wave-length was increased. On 100 meters three watts were found to be sufficient. From these facts the following theory was formulated:

During darkness, between two points reliable and constant communication may be maintained on waves between 100 to 300 meters. The power used may be very small indeed, even less than three watts, and an increase of power over and above that necessary to maintain a normal *daytime* radius of 30 to 40 miles does not appear to materially add to the *distance* over which communication may be established. The shorter the wave-length the more certain will be this transmission and reception. Such transmission and reception is not purely radio propagation as we know it, but is a matter of wired wrieless, the Heaviside layer being one conductor, the earth the other. Alternatively, the Heaviside layer and the earth may be regarded as two plates of a condenser and any electrical change in such a condenser will affect a conducting body placed between its plates, as in the case of a receiving station. This would explain the great success of the Beverage type of aerial.

The Heaviside layer is assumed to be between 30 and 40 miles from the surface of the earth and it may possibly be just moisture. Here we see the necessity of a 30-mile day range; the Heaviside layer must be reached. A 30-mile day radius will apparently reach it.

The suggestion may be put forward that the foregoing theory cannot be correct since this wired wireless would appreciably affect long waves as well as short. But the Heaviside layer and the earth have many imperfections from the radio and electrical point of view. They are variable. They are, in fact, poor plates of a condenser to long waves of low frequency but to waves of very high frequency they become more ideal as conductors. And here we see the reason for fading. We have found by experience that transmissions on waves from 200 to 800 meters are susceptible to fading during the dark hours. But the word fading is misleading and is not strictly true. What happens is that a station heard dur-



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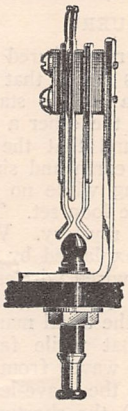

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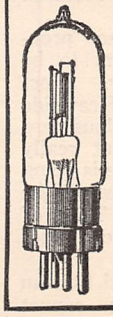

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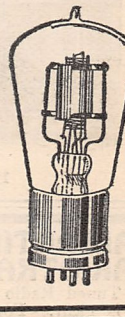

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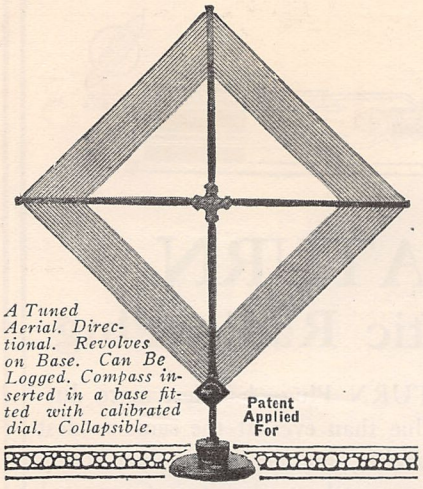

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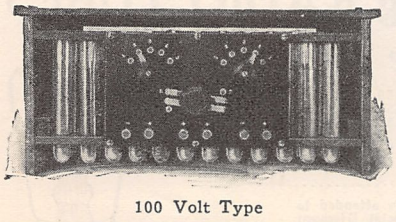

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ing the daytime becomes far louder at night. At times, these extra-loud signals fade, i. e., lapse back to the ordinary daytime strength. The loud night signals appear to be due to the phenomena of wired wireless explained above. And the momentary fading is due to momentary imperfections in either earth or Heaviside layer, or momentary impedances in the resistance of the earth. It is very noticeable that imperfections such as these, whatever their causes, occur at different times between the transmitter and the receiver, so that two receivers situated at, say, north and east, will experience different periods of fading from a station situated to the west.

RADIO NEWS QUERY

In this connection, it is remembered that the Editor of RADIO NEWS stated that two men may be listening to a certain station, one using aerial and earth, the other a loop and multi-tube amplifier, and that the listener using the aerial and earth and simple receiver may observe fading while no fading at all is observed by the loop set. This, the Editor regarded, as a mystery. What really happened might be explained by saying that one was receiving wired wireless as explained, while the other picked up pure radio waves propagated in the usual manner.

It is worthy of note that while fading is observed every night on waves from 200 to 800 meters, the shorter the wave-length (the greater the frequency) the shorter the periods of fading. Down on 100 meters and below, no fading is noticed. This is explained by the fact that any momentary imperfection in the conducting media (Heaviside layer and earth) may prove an impassable barrier to waves of a comparatively low frequency but leave sufficient conductivity for waves of a higher frequency and shorter length. It is proved that on 100 meters no appreciable fading is observed. Not that there is no fading. There is, but it is manifested in an entirely different manner, in what some engineers term "night distortion." In practice, it is heard as distorted speech. Transmitted voice tone occasionally sounds as though the speaker were using a very bad microphone, or talking with a plum in his mouth. The missing links in the speaker's articulation are due to slight and rapid fading caused by momentary imperfections in the Heaviside layer, or variations in conductivity of the earth.

EXPLANATION OF KDKA RANGE

It appears from the foregoing theory that could the Pittsburgh station, KDKA, transmit on a wave of, say, 20 meters the speech would at all times be pure and undistorted, due to the extreme high frequency of the wave used. And could the wave front of KDKA be directed to the Heaviside layer far better signals would be received in England. In this connection it should be remembered that Dr. Eccles once advanced a theory that a series condenser in a transmitter caused the wave-front to be focussed on the Heaviside layer.

That atmospherics are not so prevalent on very short waves appears to be explained by the foregoing theory. Short waves, due to night and the Heaviside layer, may be received with ridiculous ease with a single-tube receiver. What really happens is that only a 30-mile range is being received, i. e., the distance between the aerial and the Heaviside layer. This, of course, accounts for the absence of atmospherics.

To sum up it may be safely said that an efficient receiver or transmitter cannot really be designed to deal with short waves which will receive or transmit long-distances during the daytime. One thing is apparent, however, the night conditions begin far

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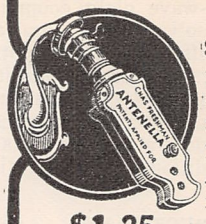

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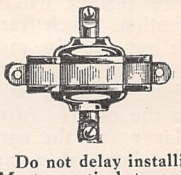

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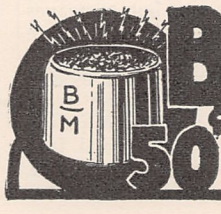

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earlier on waves below 150 meters and remain constant far later in the following morning than the same conditions on longer waves. The shorter the wave, the longer the duration of the night conditions when great distances may be accomplished, and likewise as the wave-length is increased and the frequency becoming lower and lower the night ranges are shortened. On 1,000 meters and above we have hardly any noticeable increase in signal strength by night. It is a matter of interest that the Czecho Slovakian station at Prague, normally sending on a long wave, may be heard at a strength many times multiplied by night on a very short wave. The harmonic heard from that station is louder than the real transmission on the long wave. Another point worth mentioning is that during any eclipse of the sun by the moon, night conditions prevail in radio, and great distances are spanned.

HAMS TAKE NOTE

Editor, RADIO NEWS:

I regret that you did not include my call letters, etc., in your list of British amateur stations. I am particularly interested in trans-Atlantic work and have received 13 American broadcast stations to date, as well as many amateurs, with detector and two step audio. I am very anxious to conduct tests with amateurs on your side, as I am an American studying in England, holding a license for station 1BGO in America, as well as 6ZX in England. For transmission I have a 250-watt C.W. and phone set (110 meters) and a 10-watt C.W. and phone set (440 meters). For reception, a detector and two step audio and a six-tube Super-Heterodyne and a special 100-meter receiver.

Best 73's,
HENRY FIELD,
Baggrave Hall,
Leicestershire, England.

NEW QRA's

9CVZ—(Change of address) Dwight Bancroft, 4028 Abbott Ave., So., Minneapolis, Minn. 20 watts C. W. and Fone.

5WC—(Reassigned) J. B. Gaines, 1234 Kings Highway, Dallas, Texas. 10 watts C.W. and Fone. QSL's appreciated and answered.

9CEN—(Reassigned) Charles M. Conley, Seibert, Colo. 10 watts C.W. and Fone. All crds answd.

7GR—Ernest E. Harper, Station A, Vancouver, Wash. 5 watts R.A.C.C.W. All crds answd.

3AW—(Reassigned) Dwight M. Williams, 40 Jefferson Ave., Haddonfield, N. J.

8DNF—William D. Croft, 802 Enterprise Ave., McKeesport, Pa. All crds answd.

8DSS—Byron E. North, Victor, N. Y. 5 watts DCCW and Fone. All QSL's answd.

5AQH—Chas. W. Newton, Magnolia, Kan. All crds answd.

7AO (Re-assigned)—Kenneth L. King, Grandview, Wash. 5 watts ACCW; CW. All crds answd.

9ADS—Abe Benesovitz, 415 McKinley St., N. Hibbing, Minn. All crds QSL'd.

4UF—Luis Gandia, Jr., 13 Estrella St., Santurce, Porto Rico. QSL's appreciated.

4UG—Angel Libro, 11 Cruz St., San Juan, Porto Rico. QSL's appreciated.

3GR (Re-assigned)—Charles M. Hartman, Jr., 936 S. Bouldin St., Baltimore, Md. 5 watts CW, ICW and Fone. All QSL's answd.

6BVY—Elvyn J. Beall, Newman, Calif. 5 watts CW. All crds answd.

3ADS (Re-assigned)—Joseph Cohen, 133 Tenth St., N. E., Washington, D. C. All crds answd.

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Name.....
Address.....
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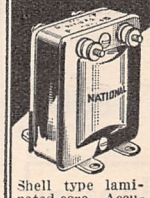

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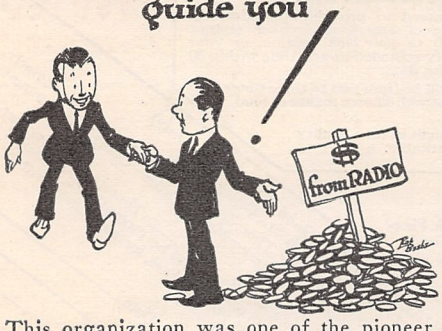

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3IO (Re-assigned)—Eskew Grant, 1351 A St., N. E., Washington, D. C. All crds answd.

9IK—Charles J. Webster, Cogswell, N. D., 10 watts CW, ICW and Fone. All crds answd.

6AOK—Herbert Perry, Somerton, Ariz. 5 watts SPCW. QSL's appreciated. All crds answd.

8DPE—Elton Spencer, 501 Cowan Ave., Jeannette, Pa. All crds answd.

9EAN—Clarence O. Roser, P. O. Box 161, Potosi, Wis. 5 watts CW. Will QSL. All crds answd.

9DKG—Jack R. Adams, Church St., Granby, Mo. 5 watts CW. Pse QSL. All crds answd.

6CQT—Herbert M. Stiles, 4138 Eagle St., San Diego, Calif. All QSL's anwd.

5ADD—E. B. Curtis, 216 Center St., Denton, Texas.

5CC—H. V. Shepard, 424 W. Sycamore St., Denton, Texas.

4UR—Isidoro A. Baldrich, P. O. Box 148, Cayey, Porto Rico. 10 watts and 100 watts CW, ICW and Fone. QSL's appreciated. All crds. answd.

3TG (Portable 3BLI)—At Treasure Island Camp, Pipersville, Pa., for the summer months. Charles H. Hess.

6NH (Re-assigned)—Grahame Hardy, 25 Artuna Ave., Piedmont, Calif. 10 watts CW, 1CW and Fone. All crds QSL'd.

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Can.: 1df, 2bn, 2fu, 3wg.

9EAN, P. O. BOX 165, POTOSI, WIS.

1aer, 1agg, 1avf, 1bbu, 1btr, 1cde, 1ckp, 1er, 1ii, 1mr, 1tt, 2le, 2wr, 3cj, 3kp, 3kw, 3op, 3ot, 3ov, 3qy, 4ae, 4af, 4ai, 4az, 4bg, 4cs, 4jd, 4jw, 4mi, 4nx, 4oa, 4ow, 5abd, 5ad, 5ads, 5ags, 5air, 5aiu, 5aj, 5alv, 5amz, 5cn, 5cs, 5eg, 5ek, 5er, 5fv, 5hi, 5ic, 5jl, 5jz, 5ka, 5kb, 5mb, 5mo, 5mr, 5na, 5ny, 5qs, 5rg, 5sb, 5ua, 5vc, 5vm, 5vv, 6acc, 6age, 6vo, 7co, 7hw, 7pj, 7qd, 8abu, 8adk, 8aeg, 8agc, 8ai, 8ak, 8al, 8aln, 8anb, 8anh, 8aro, 8arz, 8as, 8atc, 8au, 8aue, 8aus, 8ayl, 8azm, 8bed, 8bju, 8bjv, 8bm, 8bmb, 8bn, 8bnh, 8bul, 8bzc, 8cab, 8cap, 8cdi, 8cej, 8ceu, 8cif, 8cog, 8cpz, 8crc, 8crv, 8ct, 8cv, 8czz, 8da, 8dar, 8dbf, 8ddc, 8dg, 8dgn, 8dgr, 8dhs, 8dil, 8du, 8kn, 8kc, 8kg, 8li, 8nb, 8pu, 8rj, 8rm, 8rn, 8tj, 8wl.

9DHJ, CROWN POINT, IND. (ONE TUBE)

1aw, 1aal, 1ii, 1awe, 2ea, 2brb, 3buv, 3cbm, 3ccn, 4io, 4iu, 4jr, 4qf, 5am, 5ajp, 5eb, 5ek, 5mb, 5mo, 5ps, 5ql, 5rg, 6ahu, 6awt, 6bro, 6bvz, 6cbb, 6xad, 7abo, 7aha, 7aiz, 7ju, 7ob, 8atc, 8ah, 8bmb, 8buf, 8bzt, 8cmy, 8cnw, 8ctg, 8cpk, 8cqh, 8cei, 8ded, 8dhj, 8dhq, 8dep, 8dgo, 8dp, 8tt, 8yd, 8zz.

Spark: 9aaw, 9aoy, 9btx, 9bhg, 8cma, 9bgq, 9cxm, 9crm, 9dil, 5uk, 4fg.

1 C.W.: 2ea, 3ccd, 8ga, 9ami, (9ahe), 9azj, 9cow, 9mc.

Fone: 9abg, 9aiu, 9aio, 9auy, 9bbg, 9cdf, 9caw, 9dsa, 9dwx.

Can.: 2be, 2bn.

Gld to qsl to above.

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4dv, (4dy), 4eb, 4iz, 4kt, 4oa, 4qf, 4tj, 5aw, 5air, 6ea, 6gh, 6zp, 6amw, 6apw, 6cgw, 9eg, 9aau, 9baz, 9bmu, 9bna, 9ccw, (9cee), 9cii, 9czm, 9dbj, 9dls, (9dww), **9dxl, 9ell.**

Can.: 1ar, 1bq, 1dd, 2az, 2bn, 3bd, 3fc, 3he, 3ly, 3ml, 3ms, 3oj, 3wg, (3adn), 4fz.

3SJ, FINDERNE, N. J. (NEW QRA)

1aaq, 1abp, 1adn, 1ajc, 1ano, 1apm, 1asy, 1awc, 1bbe, 1bom, 1cjj, 1ckp, 1cpn, 1cyq, 1dal, 1dq, 1oa, 1pd, 3ahp, 3ajd, 3baq, 3blc, 3bnt, 3bu, 3cby, 3cdu, 3cgd, 3coh, 3dw, 3ek, 3fc, 3fn, 3gb, 3gc, 3kj, 3os, 3oq, 3qt, 3tp, 3vw, 3vz, 3zo, 3wv, 4io, 4oq, 5mi, 8aiq, 8agq, 8abq, 8brc, 8ku, 8dnf, 8ak, 8cko, 8bsq, 8boe, 8cej, 8ci, 8cy, 8aq, 8cci, 8cga, 8lw, 8dki, 8nb, 8ajf, 8cc, 8dk, 8daa, 8dga, 9beq, 9cyw, 9azx, 9acx, 9chc, 9daq.

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Fone: 2rb, 2rp, 2xi, 3aay, 4ab, 4af, 4ai, 4em, 4ew, 4me, 5fc, 5qd, 5agj, 5aiu, 5akf, 5amf, 5xaj, 8av, 8az, 8cd, 8do, 8ec, 8lz, 8mr, 8oi, 8rl, 8ij, 8wx, 8xc, 8xj, 8xp, 8xr, 8xw, 8ym, 8yo, 8aiq, 8azn, 8bca, 8bhu, 8bng, 8bna, 8brm, 8bss, 8bxh, 8cdp, 8cmu, 8cuj, 8cwc, 8dgj, 8dig, 8dla, 8dro, 8dqm, 8xao, 9fu, 9rf, 9qi, 9ads, 9ahj, 9ahu, 9ahz, 9agb, 9ake, 9aur, 9bbm, 9bcx, 9cfi, 9che, 9clk, 9csk, 9dbd, 9ddm, 9dil, 9dsp, 9dst, 9dvp, 9efs, 9elt.

Can.: 3ads.

Cuba: 6kw.

9CVL, ATCHINSON, KAN. (ONE TUBE)

1aac, 1abc, 1abf, 1abt, 1abx, 1aby, 1acs, 1adn, 1ael, 1aez, 1afe, 1agg, 1agh, 1agk, 1ain, 1aj, 1ajp, 1aju, 1ajv, 1ajx, 1akh, 1ali, 1alj, 1ane, 1anr, 1any, 1aol, 1aos, 1apw, 1aqf, 1aqi, 1aqm, 1ar, 1are, 1arp, 1ask, 1atw, 1aty, 1aua, 1auk, 1aur, 1avb, 1avw, 1aw, 1aww, 1axa, 1axb, 1axn, 1ayt, 1azn, 1bbh, 1bcr, 1bep, 1bgc, 1bgq, 1bgt, 1bie, 1biy, 1biz, 1bkq, 1boq, 1boz, 1bqb, 1bqw, 1brl, 1bsd, 1bse, 1bsk, 1bso, 1bsz, 1btr, 1buf, 1bus, 1bv, 1bvb, 1bw, 1bkj, 1cal, 1cax, 1cdo, 1cjc, 1cjr, 1ckp, 1cmp, 1cmx, 1cpf, 1cpi, 1cpn, 1cqi, 1ctp, 1ctw, 1cu, 1cwc, 1cwp, 1er, 1fb, 1fd, 1ga, 1gv, 1he, 1hh, 1ii, 1iv, 1jf, 1jv, 1ka, 1kc, 1kd, 1ku, 1ml, 1my, 1oj, 1pa, 1pf, 1pj, 1qp, 1qz, 1rd, 1ry, 1sp, 1sw, 1tw, 1uc, 1uu, 1wr, 1xa, 1xah, 1xj, 1xz, 1xw, 1xu, 1xar, 1yb, 1zi, 1zl, 2aay, 2aaz, 2adf, 2adp, 2adu, 2ae, 2ag, 2al, 2alj, 2aln, 2ana, 2apy, 2ate, 2au, 2avg, 2awl, 2awy, 2ay, 2ayv, 2ayz, 2azy, 2bab, 2bbn, 2bbx, 2bee, 2bjo, 2blm, 2blp, 2bmr, 2bn, 2bnz, 2bof, 2bqh, 2brb, 2bt, 2bte, 2btl, 2bum, 2buq, 2bxp, 2bxr, 2by, 2byd, 2ca, 2cae, 2cbl, 2cdn, 2cdp, 2cee, 2cg, 2cgi, 2ckj, 2ckm, 2ckp, 2cla, 2clr, 2cnc, 2cnk, 2cpa, 2cpq, 2cpx, 2cqi, 2cqp, 2crc, 2crp, 2cru, 2csr, 2cux, 2cuz, 2cvl, 2cwp, 2cx, 2cxd, 2cxj, 2cxl, 2cxw, 2el, 2gk, 2ic, 2iu, 2iw, 2jd, 2jo, 2jr, 2kd, 2kf, 2ku, 2my, 2oj, 2om, 2or, 2pd, 2tp, 2ts, 2tz, 2ub, 2rm, 2wb, 2wc, 2wr, 2wy, 2xae, 2xkl, 2xi, 2xq, 3aa, 3aai, 3aao, 3abw, 3adb, 3adn, 3ae, 3aer, 3ags, 3aha, 3ahk, 3ahp, 3aig, 3aik, 3ail, 3aix, 3aj, 3ajd, 3ajs, 3ajz, 3akl, 3anu, 3apb, 3apn, 3aqr, 3arm, 3arp, 3as, 3atb, 3ati, 3ava, 3avy, 3ba, 3bay, 3bb, 3bbu, 3bdi, 3bdo, 3bei, 3bg, 3bgd, 3bj, 3bkl, 3blf, 3blu, 3bm, 3bmn, 3bms, 3bof, 3bpp, 3bqa, 3bqp, 3bs, 3bsb, 3bss, 3btk, 3btl, 3btp, 3buk, 3buj, 3bux, 3buy, 3bv, 3bvn, 3bw, 3bwj, 3bwt, 3by, 3ca, 3cah, 3cb, 3cbl, 3cbm, 3cc, 3ccu, 3cd, 3cej, 3cel, 3cez, 3cgs, 3cjm, 3cjn, 3cjx, 3ck, 3ckj, 3ckl, 3co, 3cx, 3con, 3crd, 3ir, 3jj, 3ds, 3dt, 3eh, 3er, 3fc, 3ff, 3fy, 3gc, 3gz, 3hh, 3ii, 3iv, 3ja, 3jg, 3jl, 3jx, 3jy, 3kd, 3ko, 3kp, 3kq, 3kx, 3lb, 3lg, 3ll, 3lr, 3lx, 3lz, 3mb, 3me, 3mf, 3mi, 3mo, 3nf, 3oe, 3oh, 3oj, 3oq, 3ot, 3ox, 3ph, 3pw, 3pz, 3qe, 3qv, 3sc, 3sp, 3tb, 3ti, 3tm, 3tp, 3tr, 3ud, 3uf, 3tf, 3wg, 3ws, 3xar, 3xm, 3yo, 3ys, 3zd, 3zm, 3zt, 4ab, 4af, 4ag, 4ai, 4ay, 4bm, 4bq, 4bw, 4bz, 4ch, 4ci, 4cl, 4cm, 4co, 4cs, 4db, 4dg, 4dq, 4dv, 4ea, 4eb, 4e,q 4er, 4fa, 4fg, 4fq, 4fr, 4fs, 4ft, 4fz, 4gw, 4gh, 4gl, 4gx, 4gy, 4gz, 4hs, 4hw, 4if, 4io, 4it, 4iu, 4iz, 4jk, 4jm, 4jr, 4js, 4jv, 4ku, 4li, 4lj, 4mb, 4me, 4mi, 4ni, 4oa, 4od, 4og, 4oi, 4je, 4or, 4ou, 4pd, 4qf, 4qw, 4qy, 4rr, 4ru, 4sb, 4sh, 4si, 4sn, 4ss, 4sx, 4te, 4ti, 4we, 4xc, 4xe, 4xr, 4xw, 4yq, 6aam, 6aan, 6aao, 6abk, 6acl, 6acm, 6ad, 6adh, 6afq, 6afs, 6agk, 6agl, 6ahn, 6ahp, 6ahu, 6aia, 6aie, 6aiv, 6aiu, 6aiw, 6aja, 6ajf, 6ajh, 6ajv, 6ak, 6akk, 6akz, 6ale, 6alk, 6alo, 6ams, 6amw, 6anb, 6ane, 6anl, 6anp, 6anq, 6ao, 6aoi, 6aoo, 6aos, 6aou, 6ape, 6apw, 6arb, 6arf, 6aro, 6aru, 6asa, 6asj, 6asp, 6asw, 6aut, 6auy, 6auu, 6avr, 6aw, 6awb, 6awq, 6awr, 6aws, 6awt, 6bab, 6bah, 6bau, 6bbc, 6bbq, 6bbt, 6bbu, 6bbw, 6bca, 6ayg, 6bcb, 6bcl, 6bcz, 6bdi, 6bdr, 6bdt, 6bdu, 6bel, 6beo, 6beq, 6bez, 6bfb, 6bh, 6bhb, 6bhu, 6bic, 6bid, 6bih, 6bis, 6bjj, 6bjq, 6bkj, 6bkx, 6blb, 6blm, 6bm, 6bma, 6bmd, 6bnc, 6bnt, 6bnu, 6bo, 6bpf, 6bpm, 6bpz, 6bpl, 6brf, 6brg, 6bri, 6brm, 6bse, 6bsh, 6bsj, 6bsh, 6bsr, 6bsn, 6btt, 6bua, 6buf, 6buh, 6bui, 6bum, 6buo, 6bur, 6bus, 6buy, 6bve, 6bvg, 6bvs, 6bvz, 6bwe, 6bwp, 6by, 6cai, 6caw, 6cbf, 6cbi, 6cbu, 6cbw, 6bzd, 6cc, 6cci, 6ccy,

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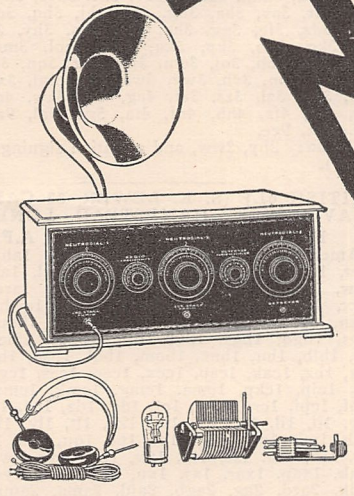

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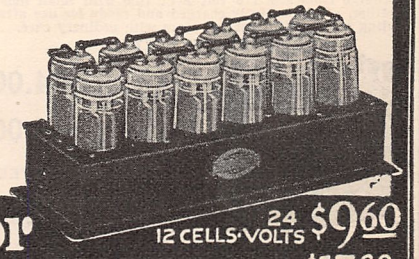

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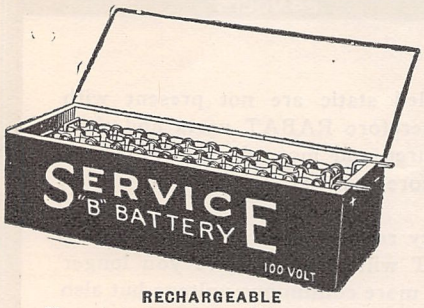

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Canadian: 1ad, 1ar, 1bj, 1bq, 1bv, 1ef, 2be, 2bg, 2bn, 2cg, 2co, 2dn, 2hv, 2ic, 3aa, 3abc, 3abn, 3ad, 3ada, 3adn, 3ads, 3adv, 3ae, 3aec, 3apt, 3aiy, 3aq, 3at, 3av, 3ba, 3bg, 3bi, 3bj, 3bq, 3ck, 3db, 3dn, 3dz, 3fc, 3gg, 3hc, 3hi, 3hp, 3hy, 3ir, 3iv, 3jt, 3kg, 3ko, 3kp, 3kq, 3kw, 3ml, 3mn, 3ms, 3nm, 3ni, 3oh, 3oj, 3om, 3pg, 3pz, 3qn, 3qs, 3sp, 3tb, 3tj, 3un, 3vh, 3wg, 3ws, 3wv, 3xi, 3xn, 3xx, 3yh, 3yv, 3zl, 3zs, 3zt, 4ag, 4aj, 4aw, 4cb, 4co, 4cr, 4er, 4fz, 4hh, 4nf, 4ta, 5go, 9al, 9ar, 9bg, 9bj, 9bx, 9ce.

Cuban: 2by, 2ww, and a station signing "jupu" (qra?).

BRITISH 6LJ (S. K. LEWER, 32 GASCONY AVE., WEST HAMPSTEAD, LONDON N. W. 6, ENGLAND (DET., 1 A.F.)

American: 1aac, 1aar, 1abf, 1abt, 1abx, 1acr, 1act, 1adl, 1ah, 1ahf, 1aib, 1aja, 1akl, 1ali, 1alk, 1alw, 1ana, 1anr, 1apu, 1apr, 1aqr, 1are, 1arq, 1arx, 1ary, 1at, 1atm, 1auw, 1avf, 1awh, 1awv, 1axn, 1ba, 1baa, 1bbo, 1bcf, 1bcr, 1bdu, 1bep, 1bes, 1bgq, 1bgs, 1bgt, 1bh, 1bhm, 1bie, 1bjm, 1bl, 1blb, 1bn, 1bne, 1bom, 1bql, 1bsd, 1bse, 1bt, 1bx, 1bz, 1cak, 1cap, 1ccx, 1cdo, 1ces, 1cgq, 1cib, 1cj, 1cjp, 1ckp, 1cma, 1cmg, 1cmk, 1cmx, 1coe, 1cpf, 1cpi, 1cru, 1csl, 1ct, 1dg, 1dz, 1eq, 1er, 1gu, 1gv, 1ii, 1il, 1it, 1iu, 1jv, 1ka, 1lt, 1lv, 1ly, 1ma, 1mb, 1mk, 1ml, 1mm, 1nt, 1pc, 1qu, 1qx, 1rj, 1rk, 1rr, 1rv, 1sa, 1se, 1tp, 1tw, 1um, 1vc, 1wl, 1xah, 1xak, 1xap, 1xar, 1xj, 1xu, 1xw, 1xz, 1yd, 2acd, 2adk, 2aed, 2ag, 2agb, 2ajd, 2ama, 2amr, 2anu, 2avg, 2awe, 2awf, 2awl, 2ax, 2az, 2azy, 2bap, 2bgi, 2bgo, 2bl, 2bmy, 2bnu, 2bpb, 2br, 2brb, 2bsc, 2bsr, 2bu, 2buy, 2bxd, 2cee, 2cei, 2cfb, 2cjr, 2cjx, 2ck, 2cla, 2cm, 2cma, 2cnk, 2cnm, 2cpd, 2cpd, 2cpf, 2cpx, 2crp, 2crw, 2csl, 2csp, 2cve, 2cvj, 2cw, 2cx, 2cxd, 2cxl, 2cxw, 2dk, 2dn, 2ei, 2el, 2em, 2fo, 2gu, 2gx, 2hh, 2hk, 2ht, 2it, 2iu, 2jd, 2kd, 2ki, 2kr, 2ku, 2kx, 2nj, 2pv, 2qe, 2rk, 2rw, 2sw, 2tf, 2tp, 2tu, 2ud, 2vf, 2ww, 2xab, 2xq, 2xv, 2ym, 3ac, 3aou, 3aqy, 3auv, 3auw, 3bay, 3bd, 3bdr, 3bfq, 3bgj, 3bii, 3bji, 3bjp, 3bjy, 3bl, 3bz, 3cc, 3cdn, 3cjn, 3hh, 3je, 3ju, 3ke, 3lg, 3mb, 3mc, 3me, 3ni, 3oe, 3oh, 3ot, 3pk, 3qv, 3te, 3tu, 3ud, 3vw, 3ws, 3xar, 3yo, 4an, 4ar, 4by, 4bz, 4cl, 4ea, 4er, 4gw, 4hs, 4ht, 4io, 4ow, 4rc, 4sh, 4xc, 4xf, 4xs, 4yx, 5air, 5ec or 5ek, 6bcl, 6bjj, 6bn, 6ut, 7ac, 7bj, 8aam, 8ab, 8abi, 8abs, 8af, 8alf, 8amr, 8ao, 8aol, 8apt, 8atd, 8avl, 8bbd, 8bbf, 8bcp, 8bnn, 8bq, 8bqi, 8bw, 8byq, 8ccj, 8cgu, 8cjd, 8ck, 8coj, 8ctp, 8cuu, 8cvx, 8cy, 8cz, 8dda, 8ddc, 8dkd, 8dku, 8dm, 8es, 8fc, 8gz, 8hc, 8ir, 8lc, 8nd, 8qa, 8rd, 8rm, 8rn, 8sp, 8tr, 8tt, 8ur, 8vw, 8vz, 8xbh, 8xs, 8za, 8zu, 9aa, 9acq, 9ahz, 9atn, 9azx, 9baq, 9bib, 9biz, 9bjt, 9bm, 9ca, 9caf, 9cax, 9ccm, 9ceu, 9cga, 9cgw, 9dk, 9eak, 9elb, 9fu, 9iv, 9jy, 9lm, 9ms, 9my, 9rm, 9tv.

Canadian: 1aq, 1bd, 1bvr, 1dd, 1dj, 1dq, 1dt, 1eb, 1ef, 1fm, 2be, 2bg, 2bn, 2bq, 2cg, 2hg, 2hn, 3adn, 3bp, 3bq, 3co, 3ko, 9ak, 9bl, 9cf.

Argentine: cb8 (on 25th May; qrz on one tube). Pse qsl. Complete log kept. All cards answered.

5AQC, FORT WORTH, TEXAS

1all, 2ik, 3ek, 3lg, 3ot, 4dg, 4dl, 4eq, 4ll, 4io, 5s too numerous, 6awt, 6bfb, 6bij, 6bjj, 6brf, 6cih, 6ka, 7di, 8anb, 8bho, 8bjy, 8bz, 8bzt, 8cs, 8dbo, 8tj, 8yn, 9aao, 9aec, 9acc, 9aau, 9aim, 9aju, 9any, 9amb, 9amu, 9be, 9bfg, 9bgl, 9bhb, 9bjw, 9boj, 9bno, 9cal, 9cjb, 9cof, 9ctb, 9dan, 9dcx, 9djr, 9dmj, 9dnp, 9dqn, 9dvk, 9dxk, 9dqu, 9ebh, 9efe, 9eky, 9en, 9hn, 9lz, 9tz, 9tv, 9yy, 9egu.

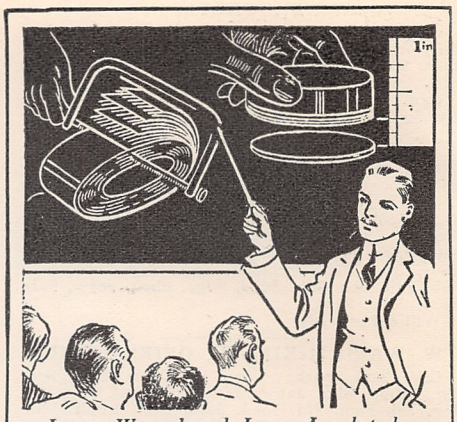
Will qsl any of above. Pse qrk 5aqc.

5ANF, ENID, OKLA. (DETECTOR ONLY)

1alj, 1are, 1bie, 1biz, 2iu, 3bpp, 3nr, 4amu, 4cb, 4dc, 4jr, 4my, 4pb, 4pk, 4tn, 5aam, 5abn, 5ail, 5amh, 5cg, 5cn, (5uk), 5xbh, 5za, 6aao, 6aur, (6avr), 6bau, (6bur), 6chv, 6eb, 6zh, 7co, 7cq, 7zu, (8adg), 8abn, 8atc, 8aut, (8bce), 8bch, 8cab, 8cci, 8cwk, 8dgj, 8dhs, 8do, 8er, (8fu), 8jt, 8yx, 8zc, (8zk), 9abk, 9aby, 9adu, 9aep, 9agl, 9ahj, 9ajg, 9ak, 9ami, 9amp, 9amz, 9aqd, 9ayx, 9azr, 9bdq, 9bfa, 9bib, 9bmd, 9bmu, 9bmx, 9bof, 9bqv, 9bqy, 9br, 9brb, 9bri, 9bwu, 9bxv, 9bxw, 9caj, (9ccb), 9ccd, 9ce, 9cen, 9cfx, 9cgq, 9cir, 9cju, 9clx, 9daj, 9day, 9dbq, 9dcp, 9dcr, 9dkq, 9dmw, 9dp, 9dro, 9dsw, 9dwn, (9ebt), 9ef, 9efz, 9egt, 9eiq, 9ejn, 9ejy, 9eli, 9elq, 9elv, (9le), 9no, 9pe, 9rc, 9rf, (9rx), 9tv.

Canadian: 4er.

Wrked cy1 qsa 3-1-24 at 3:45 a. m., C. S. T., qra? Pse qsl. Any rpts on my sigs wud be greatly appreciated; all crds gldly answd.



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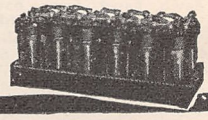

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CANADIANS: 1af, 1ar, 1bq, 8bv, 1dd, 1dq, 2cg, 2ei, 2az, 3he, 3vh, 3ly, 4bk, 4cb, 5gg, 5cf, 5an. Phone 3gg.

MEXICAN: bx, bl, 1b.

FRENCH: 8ab, 8bf.

ENGLISH: 2kf, 2sh, 2nf, 2wj, 5ko.

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PORTO RICAN: 4je.

I hv shut down fr the summer. Am receiving only; will the gang above pse qsl me a crd?

9ZT—9XAX. B. C. WALLACE, 54 PENN AVE., N. MINNEAPOLIS, MINN.

STATIONS WORKED USING 9XAX ON 109 METERS (DURING 1924)

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CANADIAN: 1bq, 1ef, 2bg, 2bn, 2og, 3bp, 3bq, 3ko, 3ly, 3aec, 4cr, 4ow, 9al.

kdef, kdeh, nkf, nkc1 (one).

The Crystodyne Principle

(*Continued from page* 295)

tiometer until the detector starts to oscillate. It is found that a strong increase of the signal strength may be obtained just below the oscillating point exactly as in a regenerative circuit. Mr. Lossev also constructed a small transmitter with such crystal contacts and since he gave the information regarding the circuit to a few amateurs in Russia, they have been communicating over short distances by means of oscillating crystal transmitters. The reception is made by means of oscillating crystals connected as in Fig. 3.

The circuits shown herewith are very simple ones which may, of course, be improved upon by experimenters interested in this subject, and we shall welcome any report of results obtained by our readers with oscillating crystals.

In closing, we wish to acknowledge our indebtedness to our French contemporaries *Radio Electricité* and *Radio Revue* for the information contained in this article.

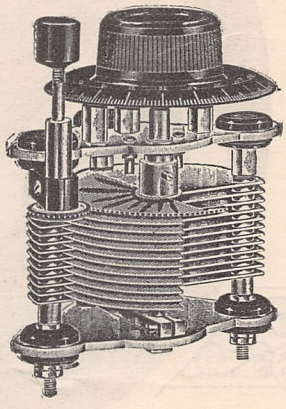
THE CANADIAN NATIONAL RAILWAYS BROADCAST STATION

Sir Henry Thornton has announced a unique radio policy for the Canadian National Railways, of which he is president The plan calls for the building of a chain of some eight or 10 broadcast stations all across Canada, and the furnishing of a receiving set considerably below the regular retail price to every one of the 100,000 employees of the railroad.

A large financial appropriation has been approved for this scheme, the principal object of which is to enable Sir Henry and other high executives to have direct heart to heart talks with the entire personnel of the system. Through no other medium than radio can this be done effectively, and, it is believed, it will create an *esprit de corps* that will spell higher efficiency and result in a vast increase of business efficiency.

President Thornton also has decided to

The NEW Heath NON-DIELECTRIC Condensers



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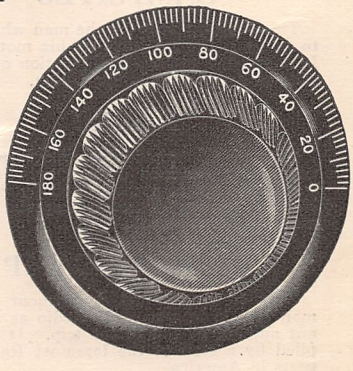

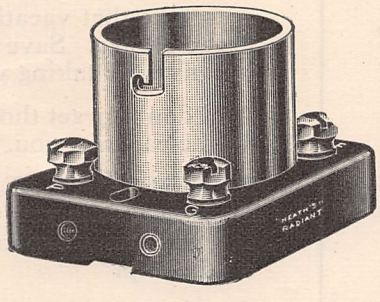

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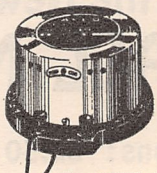

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This department is for the man who wants to camp in the outdoors on his motor trip. It shows the number and location of campsites in every state in the Union.

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Every autoist will welcome this department as a friend in need when the car breaks down on the road. Every line in it is of value to every motorist.

AROUND THE CAMP-FIRE

New and interesting things that come up from day to day and are of value to the motor traveller are in this department. It is a section of the book in which the reader always feels a personal interest.

NEW ACCESSORIES

A department for the Motor Car in which every new and worthy accessory of value to the Motor Camper and Tourist is detailed.

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MOTOR CAMPER & TOURIST

equip transcontinental trains with receiving sets to give news and entertainment to passengers. An experiment which is said to have proved that such a service would be justified was made last summer when the *Brooklyn Daily Eagle* party traveled by special train from Montreal to Vancouver. A radio receiving set was placed in one of the compartment-observation cars and gave excellent results on the trip.

Station CHYC, Montreal, will, for the present, be the broadcasting headquarters of the railroad. Some other existing stations in the Dominion may be used until the railway has time to build its own station. The first new station in the chain has been erected at Ottawa, and is known as CKCH. This station, which operates on 435 meters, will be tied in with CHYC, on 341 meters, so that programs from either Montreal or Ottawa will be broadcast simultaneously from both points.

It might be of interest to note that Sir Henry Thornton entered the service of the Pennsylvania Railroad in 1894, and was division superintendent of various divisions between 1901 and 1911. From 1911 to 1914 he was general superintendent of the Long Island Railroad, becoming, in the latter year, general manager of the Great Eastern Railway in England. He accepted his present post in October, 1922. In 1919 he was awarded the American Distinguished Service Medal, and made a Knight Commander of the Order of the British Empire.

CROSSED COIL BEACON TO GUIDE FERRY BOATS

The crossed coil radio beacon developed by the Bureau of Standards has been suggested as a means of guiding ferry boats across San Francisco Bay in foggy weather, and the Bureau believes it will prove very useful for that purpose. This type of beacon marks out a line in the ether and a boat equipped with an ordinary r ceiving set can tell whether or not she is on that line.

The San Francisco ferry boats traverse a distance of 3½ miles and carry a very large proportion of the city's commuting population, as well as all through passengers from the East and North. At times the fog is so thick that one end of the boat can scarcely be seen from the other, and strong tidal currents are encountered.

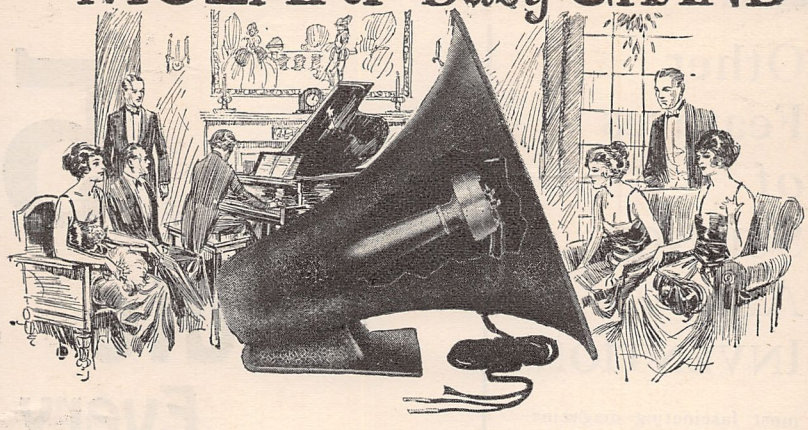
The crossed coil beacon consists of two coil antennae crossing each other at an angle of 135 degrees. A coil antenna gives its loudest signal in the plane of the coil and its weakest signal in a line perpendicular to that plane. On a line bisecting the 135-degree angle, the signals from the two coils would be of equal intensity, while if the receiving set is moved to either side the signal from one coil becomes louder than the other. The coils are connected alternately to the sending set and one of the two signal letters is sent over each coil. The operation is automatic, the letters alternating rapidly.

BROADCASTING THE MUSEUM

The Field Museum of Natural History, Chicago, Ill., has been assigned its wavelength and will start broadcasting the results of the major expeditions of last year from the Daily News Radio Station, WMAQ. While this means of attracting public attention is not unusual today, the idea of using the Museum as an entertainer is, however, new, and opens the inquiry as to the value of this form of publicity in museum management.

Can a voice crying into the night be of as great or a greater value in bringing the general public to the Museum than

Comparing The MOZART Baby GRAND



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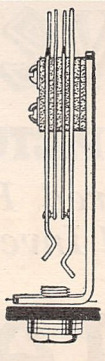

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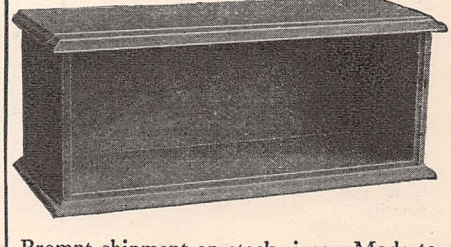

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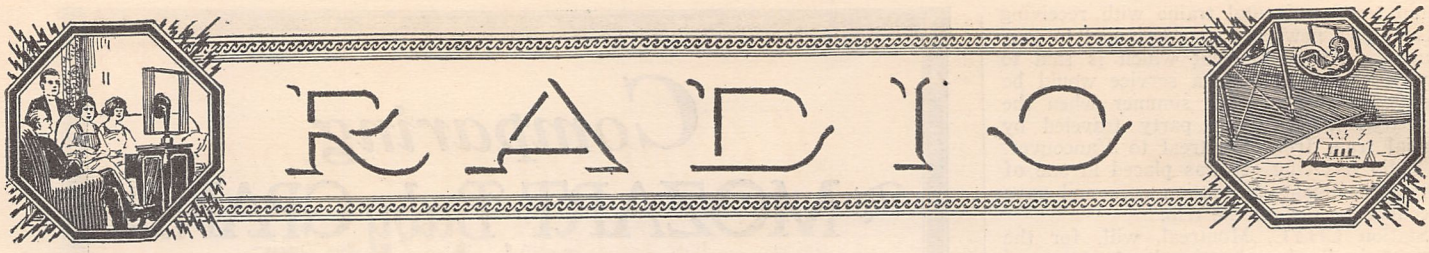

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After the Rotogravure section the picture pages come. These picture sections are the delight of every reader without exception.

Radio Section

And lastly the Live Special Radio Section that is kept so active and interesting for all our readers, giving Diagram sketches, etc., in profusion.

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50
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the newspaper, motion picture or free lectures? In many ways the answer is a positive affirmative. A recent estimate placed the number of receiving sets in use in this country at over 300,000; and since radio is at present a novelty, there is a craze for listening to anything that may be broadcast, for the mere sensation of listening-in. No radio fan is bored, and since the travel-talks given by Field Museum field collectors are above the average in radio programs, there is sure to be an avid and extensive audience. Certain it is these talks will have an even chance with a broadcast after-dinner speech or music by the Girls Scout Band. Besides the larger and more interested audience, radio has the advantage over the newspaper in that it can overcome geographical barriers and be heard by people in small villages.

HOW THE "SOS" ORIGINATED

The origin of the distress call of ships at sea, familiar to all operators and many fans, has caused considerable curiosity, and in order that a complete report could be made, the Bureau of Navigation of the Department of Commerce asked the International Bureau of the Telegraph Union for a resumé of the origin and history of "SOS."

According to advices just received from M. Etienne, Director, the first suggestion of a distress call for ships was made by the Italian delegates to the preliminary conference on wireless telegraphy at Berlin in 1903. They urged the adoption of a universal signal "SSSDDD," to be sent by ships in distress, explaining that all stations and ships should be obliged to receive the following messages, suspending other communications and passing immediately to reception. The other delegates agreed to the need for such a signal but left the final decision to a special conference.

Soon after this suggestion the Marconi Company recognized the need for a distress call, and on February 1, 1904, the famous call "CQD" was instituted on all their ships by a general order. This signal was a combination of the general call "CQ" coupled with the letter "D" to signify distress. It was used only at the order of the captain of a ship in distress or by a station retransmitting the signal. All stations were to recognize the urgency of the call and make every effort to establish satisfactory communication without delay. The dismissal of operators was to follow the misuse of the call. Several countries, including the United States, adopted "CQD," and used it until the Berlin regulations were ratified.

At the Radio Telegraphic Conference in Berlin in 1906 the German Government submitted the following suggestions relative to a standard distress call: "Ships in distress will make use of the following special danger signal: . . . - - - . . . (SOS)."

Previously German ships desiring to communicate with all vessels in their proximity, without knowing their names or calls, would send an inquiry signal "SOE." Germany planned to suggest this signal as the international signal, but as the last letter, "E," represented by a single dot, was not believed sufficiently characteristic, being easily susceptible to loss, especially during atmospheric disturbances or in heavy traffic, or when carelessly transmitted. The delegates in 1906 suggested the final letter as "S," thereby having the honor to define what became the universal signal, ". . . - - - . . ." ("SOS").

Interpretations such as "Save our souls," "Save our ship" given the call, the Berne Bureau points out, should be accepted with reserve. The Italian proverb, "If it is not true, it is well invented," they suggest is applicable to the literal translations offered. In a similar manner, Berne reports, the Marconi signal "CQD" has been interpreted to mean "Come quick, danger."

The distress signal "SOS" was adopted

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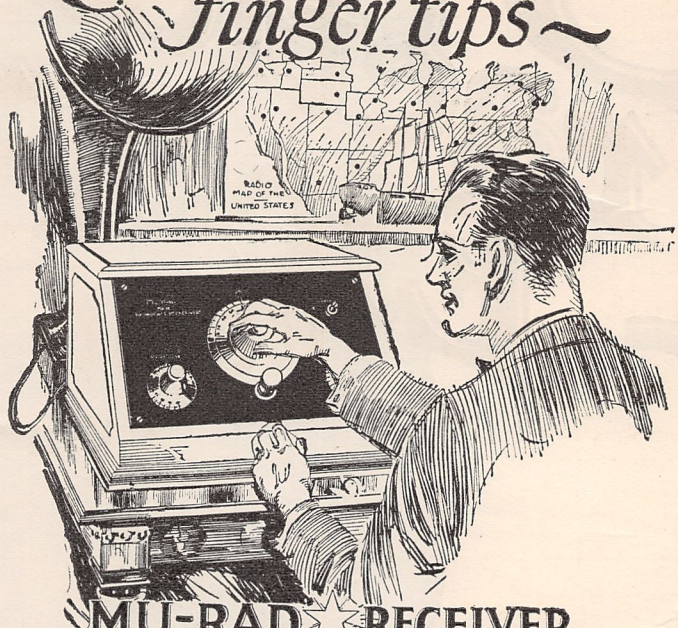

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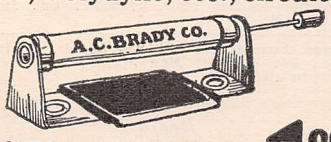

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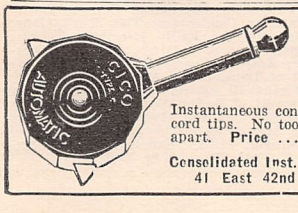


CICO

Automatic Plugs

Instantaneous connection. Just insert cord tips. No tools. Nothing to take apart. Price 80c

Consolidated Inst. Co. of America, Inc.
41 East 42nd St., New York

officially and put into effect by the International Radiotelegraphic Convention of Berlin in July, 1908. It was a matter of keen regret to the Marconi operators that their old signal "CQD" was not adopted, and many continued to send "CQD" as well as "SOS" when accidents occurred. "CQD," however, was gradually forgotten. In 1912 the United States adopted "SOS" when the international agreement was accepted.

COMMUNITY ANTENNA PRACTICAL SOON

The "coupling-tube unit," by means of which several receiving sets may use a single antenna, has been made available to the public, according to Naval radio experts. This device was invented and perfected by Dr. A. H. Taylor and Mr. L. C. Young of the Naval Radio Laboratory at Bellevue, Md., and has been demonstrated on board the U. S. Battleship *Colorado*. By connecting a coupling-tube unit between each receiving set and the single antenna suspended from the masts, several incoming messages on different wave-lengths were received simultaneously, while three messages on other wave-lengths were transmitted from the vessel.

Patents on this new radio device, which makes the operation of several sets independent of each other, even when receiving on a common aerial, are pending and consequently the inventors do not care to reveal the exact hook-up or details of the apparatus. In general, it is said to include a coupling resistance so high that the strength of the incoming signals are reduced materially, requiring at least a three- or four-tube set. A radio frequency step in the form of a radio frequency trap, which eliminates any regeneration is required and, of course, a receiving set with a detector tube. Reception is improved with two tubes of audio frequency amplification.

The military value of the coupling unit to the Navy is very high, since it enables a vessel or station to carry on several times as much business or traffic as has heretofore been possible without interference, and the Navy holds the rights for military use. It has become a part of battleship standard equipment. To the general public its chief interest will be that it will permit the use of a single aerial on large apartment houses or hotels, where each tenant wants to operate his own set independently of others. A lead-in can be run into each apartment or suite, the owner specifying that each tenant must use a coupler unit and not connect his receiving set directly with the plug in his suite. Many unsightly aerials on housetops can thus be eliminated. Big radio manufacturers are said to have made overtures to Dr. Taylor for permission to manufacture his units, but to date the name of the manufacturer has not been announced.

NO MORE CHILD-EATING BEARS IN BED-TIME STORIES

From the land where wild game is still plentiful has come a request to WGY, the Schenectady, N. Y., radio broadcast station, that child-eating bears be deleted from bed-time stories for the children. In a country where bears are a frequent sight, such stories, it is explained, put fear in the hearts of children.

The letter came from a resident of Lee Valley, seven miles from New Ontario, Canada. He is well over 70 years of age and has lived at Lee Valley for 30 years.

"I want to file a protest against the bed-time stories for the children about bears eating up little boys, or wanting to. Remember, that stuff goes to this new country where there *are* bears. There are few children going to school who haven't seen a bear. Boys eight or ten years old only laugh at such stuff here but the little tots are made afraid."

The "DE LUXE" COAST TO COAST 5-TUBE NEUTRODYNE

Using Standard, Genuine Licensed Hazeltine Parts, Synchronized and Matched

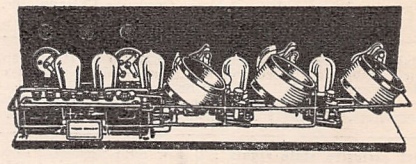
NEVER BEFORE in Radio has there been a proposition like this, NOW bringing the finest and most efficient of radio down to the level of everybody's purse. Here is luxurious beauty that a millionaire would envy. Here is the Design, the Synchronization and the Resulting Power to gather in broadcasts from coast to coast. No money has ever bought greater handsomeness. Three to five times the price cannot NOW buy better Results. You must and will be SATISFIED, or your money is returned.

$34.49 C.O.D. with *Written* Money Back Guarantee Send No Money

THE "DE LUXE" is new among Neutrodyne sets. Our engineers have taken time to study and to compare constructions and performance. They have discarded weaknesses and adopted only the strongest, most efficient features. The new "De Luxe" is now the superlative realization of months of preparation. It achieves the outstanding quality which the whole world of fans have waited for. It has created enormous demand permitting sale at far below all customary ideas of value. We have low priced it for the multitudes.

The parts are not only matched in appearance to make the finished instrument of incomparable beauty, but they are also matched from the more vital standpoint of synchronization. This is THE SECRET of "De Luxe" SUPERIORITY. The "De Luxe" mechanical and technical DESIGN stands head and shoulders above all others. The SYNCHRONIZATION of this Design is now the ultimate conception of neutrodyne leadership.

Repeatedly the need for phones on the "De Luxe Neutrodyne" has been proven superfluous. Innumerable customers have bought no phones. In our own laboratory tests most of our logs of broadcasts have been made entirely on the loud speaker. And in the matter of delicate tuning, equally extraordinary results are achieved. Many times we have tested within ½ mile of WEAF, one of the most powerful broadcasting stations in the world, and we have tuned WEAF out, and Chicago in. Your "De Luxe" is ready for you now—with written money-back guarantee—to give to YOU the same satisfaction, and the same fine results.



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1 Drilled Mahoganite Panel, polished mahogany effect, engraved in gold.
3 Four-inch Mahoganite Dials, gold engraved.
2 Gold Plated Jacks.
3 Genuine Hazeltine Neutroformers mounted on the famous Comsco-Bakelite End Condensers Positively the only Neutrodyne Kit including them.
2 Hazeltine Neutrodons.
5 Heavy Bakelite Sockets.
1 6-Ohm Rheostat with gold plated knob to match panel.
1 30-ohm Rheostat with gold plated knob to match panel.
2 Genuine Killark Completely Shielded Audio Transformers.
1 Baseboard.
20 Feet Tinned Bus-bar.
1 .00025 Freshman Grid Condenser.
1 Tubular Glass Grid Leak.
1 Set Engraved Binding Posts.
1 .002 Micon Condenser.
1 .006 Micon Condenser.
Exact size special panel-base, blue print and instructions.

All packed in attractive box. **Complete Building Kit, $34.49 C. O. D.**

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5 Tested Tubes (Type 201-A) $19.50
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1 60-Ampere Hour Storage Battery, guaranteed 2 years..... 11.25
1 pr. 3000-ohm Head Phones and Cord... 3.75
1 Phone Plug, double.. .90
1 Antenna Equipment .. 1.50

Complete Outfit, $43.40 C. O. D.

(Parts Also Sold Separately)

If you order Building Kit and Operating Outfit both together, we will include Fine Mahogany Finish CABINET FREE.

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Send for Letters from Users Everywhere. DX Tests. Pictures. Maps, etc.

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Objectionable or misleading advertisements not accepted. Advertisements for the Nov. issue must not reach us later than Sept. 1st.

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Agents Wanted in every city and town to sell standard radio apparatus. Attractive discounts given. If interested write us at once stating age and radio experience. Wilmington Electrical Specialty Co., Inc., 405 Delaware Ave., Wilmington, Delaware.

General Agents—Service Men! Genuine Gold Letters for store windows easily applied. 20 per cent cash commission on all orders from local agents appointed by you anywhere. 50 per cent discount on your own orders. Free samples. Metallic Letter Co., 422 N. Clark St., Chicago.

Agents—Write for Free Samples. Sell Madison "Better-Made" Shirts for large Manufacturer direct to wearer. No capital or experience required. Many earn $100 weekly and bonus. Madison Mills, 564 Broadway, New York.

Big Money and fast sales. Every owner buys gold initials for his auto. You charge $1.50; make $1.35. Ten orders daily easy. Write for particulars and free samples. American Monogram Co., Dept. 133, East Orange, N. J.

We want Salesmen and Agents, either whole or side line, to sell our low priced radio books to the trade. Excellent proposition for live wires. The E. I. Company, Publishers, 233 Fulton St., New York City.

Big Money and Fast Sales. Every owner buys gold initials for his auto. You charge $1.50, make $1.44. 10 orders daily easy. Samples and information free. World Monogram Co., Dept. 27, Newark, N. J.

Get into the tailoring game—one of the most profitable of all lines in the selling field. Experience isn't necessary, and spare time will do. We teach you how to sell our line, and supply you with everything necessary to go out and make from $10 to $20 a day from the very first day. Our selling outfit is the finest ever gotten together and shows more than 100 large samples of finest quality Virgin Wool suitings. Many of them our own exclusive patterns. Also a big showing of high-class heavyweight overcoatings. You do no delivering with our line. You just write your orders. We do the rest. Your profits run big and you get them cash with order. If you want to get into this most profitable business, write us quick. Address Goodwear Chicago, Inc., Dept. 170, Chicago.

Make $10.00 to $30.00 a day—New Radio or Phonograph Device. Stops all noise and scratching—Sells on sight or money refunded. Mail us $1.00 for two sets—sell for $1.00 a set. Extra discount on repeat orders. Illinois Mechanical Laboratories, 2210-2214 Michigan Ave., Dept. B, Chicago.

Get exclusive state rights sell new auto product. Costs 50c including literature, sells $3.75. Samples to try sales possibilities which retail for $11.25 free to agents. Mickman Co., St. Paul, Minn.

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Make $100 Weekly in Spare Time. Sell what the public wants—long distance radio receiving sets. Two sales weekly pays $100 profit. No big investment, no canvassing. Sharpe of Colorado made $955 in one month. Representatives wanted at once. This plan is sweeping the country—write today before your county is gone. Ozarka, 813 Washington Blvd., Chicago.

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Learn Chemistry at Home—Dr. T. O'Conor Sloane, noted educator and scientific authority, will teach you. Our home study correspondence course fits you to take a position as chemist. See our ad on page 405 of this issue. Chemical Institute of New York, 66 West Broadway, New York City.

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24 Words—355 Rural Weeklies $14.20. Admeyer, 4112-R Hartford, St. Louis.

For Inventors

Inventors' Educator: 900 Mechanical Movements. 50 Perpetual Motions. How to procure and sell patents. Mechanical movements greatly assist inventors, suggest new ideas. Explains how to select an attorney and avoid Patent Sharks. Price $1.50. Postage free. Albert E. Dieterich, 690 Ouray Building, Washington, D. C.

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Five tube Neutrodyne guaranteed perfect $59. Must sell. Shaw, Marathon, Texas.

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For Sale 200 Watts 1000 Volts D. C. Generator with 110 Volt A. C. Motor $80.00 complete, other high voltage Generators in stock. Morton Electric Co., 4832 Rice St., Chicago, Ill.

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Free—Stop using tobacco. We will give free information how to conquer habit easily and permanently. Results guaranteed. Anti-Tobacco League, Box M, Omaha, Neb.

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We Want Salesmen and Agents, either whole or side line, to sell our low priced radio books to the trade. Excellent proposition for live wires. The E. I. Company, Publishers, 233 Fulton St., New York City.

Earn $25 Weekly, spare time, writing for newspapers, magazines. Experience unnecessary; details free. Press Syndicate, 973, St. Louis, Mo.

All Men, Women, Boys, Girls, 17 to 65 willing to accept Government Positions $117-$250 traveling or stationary; Write Mr. Ozment, 251, St. Louis, Mo., immediately.

Detectives Needed Everywhere. Travel. Experience unnecessary. Write George Wagner, former Government Detective, 1968 Broadway, N. Y.

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Used Correspondence Courses bought and sold. Bargain catalogue 1,000 courses free. Students' Exchange, Dept. 5, 47 West 42 St., New York.

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Don't Buy a Bicycle Motor Attachment until you get our catalog and prices. Shaw Mfg. Co., Dept. 6, Galesburg, Kansas.

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Earn $25 Weekly Spare Time writing for newspapers, magazines. Experience unnecessary; details free. Press Syndicate, 972 St. Louis, Mo.

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Patents. Send drawing or model for examination and report as to patentability. Advice and booklet free. Highest references. Best results. Promptness assured. Watson E. Coleman, Patent Lawyer, 644 G Street, Washington, D. C.

Lacey Patent-Sense. See page 400.

Patents—Send for form "Evidence of Conception" to be signed and witnessed. Form, fee schedule, information free. Lancaster and Allwine, 269 Ouray Bldg., Washington, D. C.

Inventors—Should write for our Free Guide Books and "Record of Invention Blank" before disclosing inventions. Send model or sketch of your invention for our Free Examination and Instructions. Radio, Electrical, Chemical, Mechanical and Trademark experts. Terms reasonable. Victor J. Evans & Co., 922 Ninth, Washington, D. C.

Personal

Lonely Hearts—Exchange letters, make interesting new friends in our jolly club. Eva Moore, Box 908, Jacksonville, Fla. Enclose stamp.

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Lonesome—Join our club—make acquaintances everywhere. Big illustrated book with descriptions and photos, sent in plain wrapper for ten cents. Bonafide Co., Dept. 58, Kansas City, Mo.

Exchange cheery letters with new friends. Write Betty Lee, Inc., Box 820 City Hall Station, New York City. Stamp appreciated.

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Attention!—50 Vacuum tube hook-ups. The greatest collection of vacuum tube circuits ever brought under two covers at such insignificant cost. These diagrams will be found in the great "Rasco" catalog, which contains raw materials and parts in a greater profusion than any other catalog. 15c in stamps, or coin, will bring the catalog to you. Radio Specialty Co., 96-98 Park Place, New York City.

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Navy Transmitting Sets must sell cost $250. $25.00 Navy tubes $2.75. DeForest 50 watters $11.50, cost $72.00. New Storage Batteries, 6 volts cost $12., $4.00. Edison Elements .04 pair. 824 North Fifth, Philadelphia, Pa.

Is your Neut Right? To revitalize unneutralizable Neutrodynes, we devised this Kladag Coast to Coast Circuit. Uses same panel, etc., as Neut, except three less parts. Merely rewire. Success certain. Necessary stabilizer. 22 feet gold sheathed wire, circuit and complete, simple instructions—$5.00 prepaid. Many have already rebuilt their Neuts—and written wonderful testimonials. Thousands will do it. Be First—have the finest five tube set in your neighborhood, revitalize others' Neuts. Description, etc.—10c. Radio Lists—2c. Stamps accepted. Kladag Laboratories, Kent, Ohio.

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New B Battery. Low cost, lasts several times as long as the best. Batteries ready to assemble, no recharging. $1.00 brings detailed instructions. Seliger's, 959 Frankford Ave., Phila., Pa.

Radio Fans and B C L's qualify for License during spare time one week. Qualifying records $1.50. Licensed students free. Method $2.50. Dodge Radio Shortkut. Dept. N, Mamaroneck, New York.

Sales Manager Wanted

Wanted: Sales Manager by manufacturer of high grade line of Radio Products. One who is experienced and familiar with national distribution. The American Specialty Company, Bridgeport, Conn.

Radio

The How and Why of Radio Apparatus, by H. W. Secor, E. E. This newest book on radio matters fulfills a distinct gap in wireless literature in that, while the treatment is made as understandable and as free from mathematics as possible, it at the same time incorporates a wealth of technique and instruction for the Radio Amateur—the Radio Operator—the Installation and Designing Expert—as well as teachers and students of the subject in general. A very broad field has been covered by the author, at the same time giving a great deal of information not found in other text books. If you are engaged in any branch of the Radio or allied arts at all you will surely need this latest contribution to radio literature, which is destined to be found on every radio man's book shelf before long. A glance at the following list of chapters gives but a very scant idea of the extensive and useful radio knowledge provided in its text. The Induction Coil; The Alternating Current Transformer; Radio Transmitting Condensers; The Spark Gaps; Radio-Transmitting Inductances; Radio Receiving Tuners; Radio Amplifiers; Construction of a Direct Reading Wavemeter and Decremeter; Antenna Construction; The Calculation and Measurement of Inductances; Appendix containing very useful tables, covering all subjects treated in this very unusual book. This newest of Radio Works, cloth bound in Vellum de Luxe, Gold Stamped and Hand Sewed, has 160 pages. Size of book, 6x9 inches. The How and Why of Radio Apparatus. Postpaid, $1.75. Experimenter Publishing Co., Book Dept., 53 Park Place, New York City.

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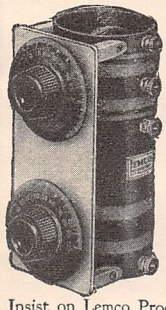

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How to Make Radio Frequency Amplifiers. This book is for the more advanced amateur, showing the construction of the Radio Frequency Amplifying Transformer and giving complete constructional data. It shows the application of Radio Frequency to amplifying units that the amateur may already possess and gives 15 hook-ups showing practically every use Radio Frequency Amplifying Transformers can be put to. 32 pages, 15 illustrations; bound in beautiful two-color cover. Prepaid 25c. The E. I. Company, 233 Fulton St., New York City.

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A Salesman wanted in every town or city within 25 miles of a broadcasting station to sell Radiogem, the complete radio receiving set that retails for $2.50. With Radiogem there is nothing else to buy—the outfit includes the Radiogem receiving apparatus, 1,000 ohm phone, and aerial outfit. The cheapest radio outfit on the market—yet as practical as the most expensive. Big money to the right men. Send $2.00 for sample outfit. The Radiogem Corp., 66-R West Broadway, New York City.

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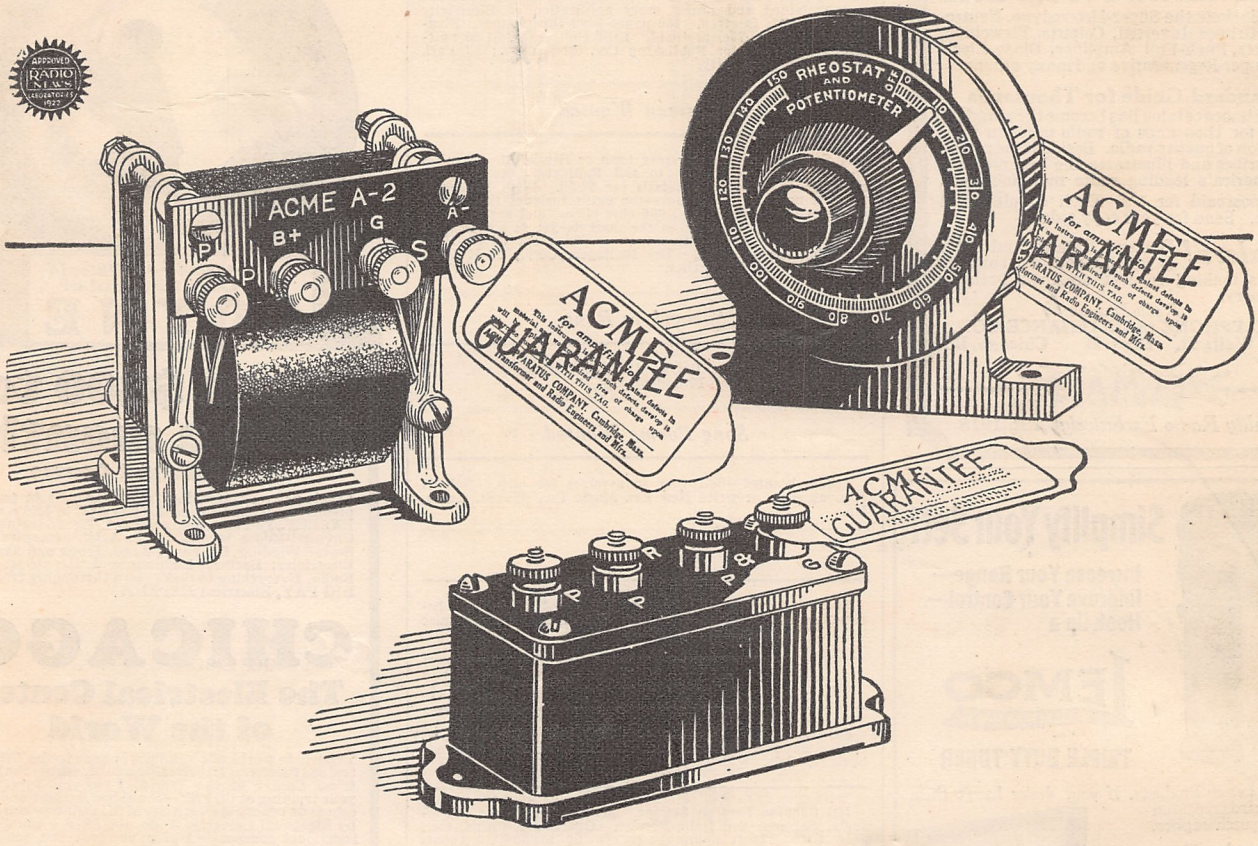

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If you think you are not getting the proper results with Acme Apparatus, write to the Acme Engineering Service, Cambridge, Mass. Send 10 cents for 36-page book — "Amplification without Distortion," which contains many diagrams and valuable hints on how to build a set and how to get the most out of it.

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I enclose 10 cents (U. S. stamps or coin) for copy of new edition of "Amplification without Distortion," containing many wiring diagrams and valuable hints on how to build a set and how to get the most out of it.

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5 Radio Winners!

Micrometer Control With One Knob
Noiseless—Stepless—Selective

* **Bradleystat**
REGISTERED U.S. PAT. OFF.
PERFECT FILAMENT CONTROL

Noiseless, stepless filament current control for ALL tubes. Is standard equipment on many sets, including Amrad Console models.

Price • • $1.85

* **Bradleyleak**
THE PERFECT GRID LEAK

Range—¼ to 10 Megohms. A grid condenser of 0.00025 mf. supplied extra. Endorsed by Cockaday, Amrad, Flewelling, Crosley, etc.

Price • • $1.85
Condenser • .35

* **Bradleyohm**
THE PERFECT RESISTOR

An adjustable resistor for radio circuits. Made in three ranges.

10,000 to 100,000 ohms
25,000 to 250,000 ohms
50,000 to 500,000 ohms

Price, any range, $2.00

Bradleyometer
THE PERFECT POTENTIOMETER

A stepless, non-inductive potentiometer for all radio circuits. Complete range in half turn of knob. Made in 200 and 400 ohms.

Price,
200-ohm • $2.00
400-ohm • 3.00

Bradleyswitch
PERFECT BATTERY SWITCH

For A and B battery circuits. Only ONE hole required in panel to mount the switch. Nickel-plated and totally enclosed.

Price • • • 60c

Many new radio circuits have been introduced and numerous modifications of the old ones have been developed, but the need of micrometer control of current and voltage in radio circuits remains unchanged.

The Allen-Bradley line of radio products now includes five super-devices for radio control. The Bradleystat for filament control and the Bradleyleak for grid leak control are known the world over for unrivalled control and marvelous range. The well-known Bradleyometer also marks a distinct advance in potentiometer construction.

Now comes the Bradleyohm in three ranges to meet the demand for an adjustable resistor for resistance coupling and other applications. The demand for the Bradleyohm has grown to enormous proportions. The Bradleyswitch, also, is a marvel of compactness and convenience.

Your radio set will be tremendously improved if you standardize on Allen-Bradley products. Ask your dealer about them or write us for descriptive circulars.

Mail the Coupon Now!

*

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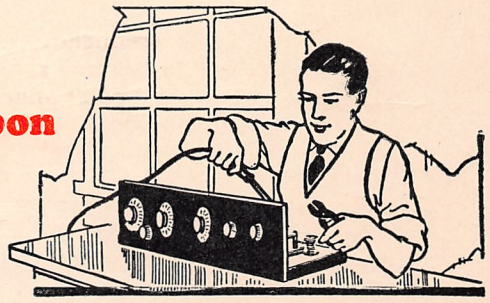

Allen-Bradley Co.
Electric Controlling Apparatus

287 Greenfield Avenue — A-B — Milwaukee Wisconsin

Manufacturers of graphite disc rheostats and electric controlling apparatus for more than 20 years

Use the Allen-Bradley Line

ALLEN-BRADLEY CO.
287 Greenfield Ave., Milwaukee, Wis.

We surely want to know more about the Allen-Bradley line of radio products. Please send us your latest bulletins about them.

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Radiotrons WD-11 *and* WD-12 *Made History!*

It isn't a genuine WD-11 unless it's a Radiotron.

It isn't a genuine WD-12 unless it's a Radiotron.

It isn't a genuine UV-199 unless it's a Radiotron.

It isn't a genuine UV-200 unless it's a Radiotron.

It isn't a genuine UV-201-a unless it's a Radiotron.

You Can Change Your Set to Dry Battery Operation.

If your radio set is equipped with navy type tube sockets, you can change to dry battery operation by inserting WD-12 Radiotrons. Ask your dealer for information as to how this can be done.

These are dry cell tubes—the tubes that made possible the swift progress of radio in the home everywhere. They meant clear tone—undistorted detection—radio and audio amplification—and volume reproduction — all with dry batteries. They meant radio in the city—on the farm—off in camp—everywhere!

And to-day, there are millions of these popular Radiotrons in use. Today everybody knows them familiarly as "WD-11's" and "WD-12's." But they are not genuine unless they are RADIOTRONS.

Always be sure to look for that mark on the base, and for the RCA mark on the glass. It's important, whether you are buying a new set with the Radiotrons in it, or buying new Radiotrons to replace old ones. Always look for the Radiotron mark and the RCA mark. Then you have the genuine — sure to live longest — serve best.

Radio Corporation of America

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